



NEW ZEALAND

EDICT OF GOVERNMENT

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AS-NZS 5026 (2012) (English): The storage and handling of Class 4 dangerous goods [By Authority of Department of Mines and Petroleum, Government of West Australia]

*We will sell to no man,
we will not deny or defer to any man either justice or right.*

Magna Carta—Tūtohunga Nui

*Kore rawa e hoko ki te tangata, e kore e whakakāhoretia,
e tautuku rānei te tangata ki te ture, tika ranei.*



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Australian/New Zealand Standard

The storage and handling of Class 4 dangerous goods



AS/NZS 5026:2012

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee CH-009, Safe Handling of Chemicals. It was approved on behalf of the Council of Standards Australia on 13 January 2012 and on behalf of the Council of Standards New Zealand on 24 January 2012.

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Australian Institute of Petroleum
Australian Paint Manufacturers Federation
Consumers Federation of Australia
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This Standard was issued in draft form for comment as DR AS/NZS 5026.

Australian/New Zealand Standard™

The storage and handling of Class 4 dangerous goods

First published as AS/NZS 5026:2012.

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PREFACE

This Standard was prepared by the Standards Australia/Standards New Zealand Committee CH-009, Safe Handling of Chemicals. Preparation of the Standard was commenced following a request from the chemicals industry that a series of Standards be prepared on the storage and handling of dangerous goods.

This Standard deals with dangerous goods of Class 4, as classified in the UN *Recommendations on the Transport of Dangerous Goods—Model Regulations*, the ADG Code and the HSNO Act.

The purpose of this Standard is to promote safety wherever Class 4 dangerous goods are stored and handled, by providing requirements and recommendations that are based on industry best practices.

Australian and New Zealand references are separated by a slash (/).

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of appendices to which they apply. A ‘normative’ appendix is an integral part of a Standard, whereas an ‘informative’ appendix is for information and guidance only.

Statements expressed in mandatory terms in notes to tables are requirements of this Standard. Statements appearing as notes within the main text provide information only.

The series of publications covering the storage, handling and transport of dangerous goods presently comprises the following:

AS

1678	Emergency procedure guides—Transport (series)
1894	The storage and handling of non-flammable cryogenic and refrigerated liquids
1940	The storage and handling of flammable and combustible liquids
2187	Explosives—Storage, transport and use (series)
2507	The storage and handling of agricultural and veterinary chemicals
2508	Safe storage and handling information cards (series)
2714	The storage and handling of organic peroxides
2809	Road tank vehicles for dangerous goods (series)
3780	The storage and handling of corrosive substances
3846	The handling and transport of dangerous cargoes in port areas
3961	The storage and handling of liquefied natural gas
4289	Oxygen and acetylene gas reticulation systems
4326	The storage and handling of oxidizing agents
4332	The storage and handling of gases in cylinders
5034	Installation and use of inert gases for beverage dispensing
HB 76	Dangerous goods—Initial emergency response guide

AS/NZS

1596	The storage and handling of LP Gas
2022	Anhydrous ammonia—Storage and handling
2927	The storage and handling of liquefied chlorine gas

AS/NZS

- 3833 The storage and handling of mixed classes of dangerous goods, in packages and intermediate bulk containers
- 4081 The storage and handling of liquid and liquefied polyfunctional isocyanates
- 4452 The storage and handling of toxic substances
- 4681 The storage and handling of Class 9 (miscellaneous) dangerous goods and articles
- 60079.10.1 Explosive atmosphere—Part 10.1: Classification of areas—Explosive gas atmospheres

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard**The storage and handling of Class 4 dangerous goods**

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard sets out requirements and recommendations for the safe storage and handling of flammable solids, substances liable to spontaneous combustion, and substances that in contact with water emit flammable gases, i.e. dangerous goods that—

- (a) in Australia, are classified as Division 4.1, 4.2 or 4.3 in the Australian Dangerous Goods Code (ADG Code); and
- (b) in New Zealand, meet the 4.1, 4.2 or 4.3 classification criteria of the *Hazardous Substances and New Organisms Act*, 1996, referred to as ‘the HSNO Act’.

The Standard also applies to other dangerous goods that are assigned Division 4.1, 4.2 or 4.3 subsidiary risks by the ADG Code, except where more stringent requirements apply under another relevant Standard or regulation.

NOTES:

- 1 In Australia, this Standard is not intended to apply to consumer products and commercial cleaning products that are flammable liquid soaked solids or flammable liquid containing solids.
- 2 Dangerous goods are classified as such and listed in the *UN Recommendations on the Transport of Dangerous Goods—Model Regulations*. They are also listed in the ADG Code and HSNO Act.
- 3 Information on the hazards presented by Class 4 dangerous goods is provided in Appendix A.

1.2 APPLICATION**1.2.1 Where this Standard applies**

This Standard applies in locations that are generally industrial, commercial or rural in nature including research institutions. Its requirements apply in conjunction with, but do not take precedence over, any regulations that apply in any area.

NOTES:

- 1 An installation may come under the regulatory control of several authorities having differing areas of responsibility, and an agreement from one does not necessarily constitute an agreement from others.
- 2 The Building Code of Australia (BCA)/New Zealand Building Code (NZBC) applies to all matters relating to building works.

1.2.2 Where this Standard does not apply

This Standard does not apply to the following:

- (a) The transport of Class 4 dangerous goods, which is covered by other rules and Codes, e.g. the ADG Code/NZS 5433 or the IMDG Code.
- (b) The handling or transport of Class 4 dangerous goods in port areas which, in Australia, is covered by AS 3846.
- (c) The retail storage of Class 4 dangerous goods in retail packages, which in Australia is addressed in AS/NZS 3833.
- (d) The manufacture or processing of Class 4 dangerous goods.

1.2.3 Relationship with regulations

The requirements of this Standard apply in conjunction with, but do not take precedence over, any government regulations that apply in any area.

NOTES:

- 1 In Australia, some Class 4 dangerous goods may also be classified as workplace hazardous substances. As such they will also be subject to the legislative requirements relating to workplace hazardous substances. The requirements of the Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP) may also apply.
- 2 In Australia, the *National Standard for the Control of Major Hazard Facilities* (NOHSC:1014) may apply to the installation, depending on the size of the storage.
- 3 In New Zealand, all Class 4 substances (excluding items such as manufactured articles) are classified as hazardous substances under the HSNO Act. As such they are subject to the requirements of this Act. Whilst this Standard encompasses some of these requirements, it does not purport to specify all of them.
- 4 In New Zealand, Class 4 substances are subject to the legislative requirements of the *Land Transport Rule: Dangerous Goods 2005* during transport.
- 5 Regulatory authorities controlling various desensitized explosives may have their own regulations or may otherwise impose conditions which differ from this Standard. Recognition is given to the prerogative of such regulatory authorities to set such legal requirements and no further reference thereto is made in this Standard.

1.2.4 Minor storage (Australia only)

For minor storage of Class 4 dangerous goods (as defined in Clause 1.4.8), only Sections 1, 2, 9, 11 and 12 of this Standard apply.

1.2.5 Subsidiary risks

Where the Class 4 dangerous goods being kept have one or more subsidiary risks/hazard classifications, reference shall be made to the Australian or New Zealand legislation relevant to the Classes of those risks and the more stringent requirements shall apply.

NOTES:

- 1 Where there is no relevant Australian or New Zealand Standard for a particular Class of subsidiary risk, reference should be made to the relevant regulatory authority. The appropriate storage requirements may need to be determined by risk assessment, taking into consideration the specific properties of the substances being stored.
- 2 Under the HSNO Act, substances are assigned classifications according to their properties and all classifications are equally applicable.

1.2.6 Categories, divisions and descriptions of dangerous goods of Class 4

(Australia) For the purpose of this Standard, the categories, divisions and descriptions given in Table 1.1 apply.

(New Zealand) Under the HSNO Act a hazardous substance is assigned a hazard class, subclass and category; for the purpose of this Standard, the descriptions given in Table 1.1 apply.

1.3 REFERENCED DOCUMENTS

A list of documents referred to in this Standard is provided in Appendix B.

TABLE 1.1
CATEGORIES, DIVISIONS AND DESCRIPTIONS
OF CLASS 4 DANGEROUS GOODS

Category	Division and description of dangerous goods	
	ADG and NZS 5433 Classification	HSNO Act Classification
A	Division 4.1 (self-reactive and related substances; desensitized explosives)	4.1.2A, 4.1.2B, 4.1.2C, 4.1.2C, 4.1.2D, 4.1.2E, 4.1.2F, 4.1.2G
	Division 4.2 (pyrophoric substances)	4.2A
B	Division 4.1 PG I	Class 4.1.1A, 4.1.3A
	Division 4.2 PG I	Class 4.2A
	Division 4.3 PG I	Class 4.3A
C	Division 4.1 PG II	Class 4.1.1B, 4.1.3B
	Division 4.2 PG II	Class 4.2B
	Division 4.3 PG II	Class 4.3B
D	Division 4.1 PG III	Class 4.1.3C
	Division 4.2 PG III	Class 4.2C
	Division 4.3 PG III	Class 4.3C

1.4 DEFINITIONS

NOTE: Definitions relating to containers are aligned with those of the *Policy Proposal for Workplace Chemicals Model Regulations* as prepared by Safe Work Australia rather than the ADG code.

For the purpose of this Standard, the definitions below apply.

1.4.1 Access

A means by which a person or vehicle can approach or leave a specific location. The term includes walkways, platforms, stairways, ladders, roads and all provisions for safe entry and exit.

1.4.2 ADG Code

The *Australian Code for the Transport of Dangerous Goods by Road and Rail*, published by the National Transport Commission.

1.4.3 Boundary

The perimeter of the whole of the site under the same occupancy as the storage area.

1.4.4 Bulk

(Australia) Dangerous goods are in bulk if—

- (a) they are in a container or receptacle that has a capacity of more than 500 L; or
- (b) there is more than 500 kilograms of the goods in a container; or
- (c) the goods are not in a container and there is more than 500 kg of the goods in an undivided quantity.

(New Zealand) Hazardous substances in the form of—

- (i) a liquid, in a container in an undivided quantity exceeding 450 L or
- (ii) solids, in a container in an undivided quantity exceeding 400 kg.

1.4.5 Bund

An impervious embankment of earth, or a wall of brick, stone, concrete or other suitable material which may form part or the entire perimeter of the compound.

1.4.6 Capacity

The total internal volume of the container at a temperature of 15°C, expressed in litres (L).

1.4.7 Class (of dangerous goods)

(Australia) The number assigned to dangerous goods which exhibit a common single or most significant risk, determined from the criteria of the *UN Manual of Tests and Criteria* and listed in the ADG Code.

(New Zealand) The hazard classification assigned to a hazardous substance in accordance with the HSNO Act to represent the hazard property of the substance. Each substance may have multiple classifications.

1.4.8 Class 4 dangerous goods

Flammable solids; substances liable to spontaneous combustion; substances that, in contact with water, emit flammable gases.

Class 4 is divided into three divisions as follows:

- (a) Division 4.1 (see Clause 1.4.16);
- (b) Division 4.2 (see Clause 1.4.17); and
- (c) Division 4.3 (see Clause 1.4.18).

NOTE: The HSNO Act does not use the term 'division' as it is covered by the term 'subclass', however for simplicity in this Standard, the term 'Division' is used throughout the document.

1.4.9 Combustible materials

Materials that can contribute to sustaining a fire, and are deemed combustible when tested in accordance with AS 1530.1/NZS/AS 1530.1.

1.4.10 Compound

An area bounded by ground contours or by a bund, and intended to retain spillage or leakage.

NOTES:

- 1 This includes the floor of the compound.
- 2 A pit or tank may sometimes be used for the same purpose.

1.4.11 Confined space

A space of any volume as defined by AS/NZS 2865.

1.4.12 Container

Anything in or by which dangerous goods are wholly or partly encased, covered, enclosed, contained or packed, whether such a thing is empty or partially or completely full.

1.4.13 Corrosivity

The potential corrosive chemical action on other materials, in particular, containers, vessels, equipment and living tissue (including skin).

1.4.14 Dangerous goods

(Australia) Substances and articles that—

- (a) satisfy the UN tests and criteria for determining whether they are dangerous goods; or
- (b) are listed in the ADG Code or are determined to be dangerous goods by the regulatory authority.

(New Zealand) Substances and articles that have one or more hazard Classes assigned to them in accordance with the HSNO Act, including packaging and empty containers that have not been cleaned after containing hazardous substances.

In New Zealand, ‘dangerous goods’ is a term used by the *Land Transport Rule: Dangerous Goods 2005*, which applies during transport. For the storage and handling of substances, the HSNO Act applies, and the term ‘hazardous substances’ is used. For the purposes of this Standard the term dangerous good is synonymous with hazardous substance and both are used interchangeably though out the document

NOTE: UN tests and criteria are specified in the *UN Manual of Tests and Criteria* and the Recommendations on the Transport of Dangerous Goods—Model Regulations.

1.4.15 Desensitized explosives

A substance is a desensitized explosive if—

- (a) in order to suppress its explosive properties, it has been formed into a homogeneous mixture by—
 - (i) in the case of a solid—wetting it with water or alcohol or diluting it with one or more other substances; and
 - (ii) in the case of a liquid—dissolving or suspending it in water with one or more other substances; and
- (b) it would, without that treatment, have been a Class 1 explosive; and
- (c) it is excluded from Class 1 by virtue of its package size or type.

1.4.16 Division 4.1—Flammable solids, self-reactive substances and solid desensitized explosives

This division comprises:

- (a) Solids that, under the conditions of transport, are readily combustible, or may cause or contribute to fire through friction.
- (b) Self-reactive substances that are liable to undergo a strongly exothermic reaction.
- (c) Solid desensitized explosives that may explode if not sufficiently diluted.

1.4.17 Division 4.2—Substances liable to spontaneous combustion

This division comprises:

- (a) Pyrophoric substances. These include solutions and mixtures (liquid or solid) that, even in small quantities, ignite within 5 minutes of coming in contact with air. These are the Division 4.2 substances most liable to spontaneous combustion.
- (b) Self-heating substances. These substances (other than pyrophoric substances) are liable to self-heating. They will ignite only when in large amounts (kg) and after long periods of time (hours or days).

1.4.18 Division 4.3—Substances that, on contact with water, emit flammable gases

‘Dangerous when wet’ substances which, in contact with water, can emit flammable gases that can form explosive mixtures with air. Such mixtures are easily ignited by all ordinary ignition sources, e.g. naked lights, sparking hand tools, or unprotected light bulbs. The resulting blast wave and flames may endanger people and the environment.

NOTE: Emitted gases may also be toxic.

1.4.19 Environmental impact, including ecotoxicity

The effect on the environment, in particular to aquatic life

1.4.20 Environmentally sensitive area

The term includes, but is not limited to—

- (a) a water catchment area;
- (b) a reservoir for drinking water;
- (c) a freshwater or marine environment; or
- (d) a national park or equivalent.

1.4.21 Explosiveness

The potential to explode when ignited, heated, or subjected to impact or shock (e.g. desensitized explosives)

1.4.22 Fire resistance level (FRL)/Fire resistance rating (FRR)

The grading period, in minutes, determined in accordance with AS 1530.4/NZS/AS 1530.4 for—

- (a) structural adequacy;
- (b) integrity; and
- (c) insulation;

and expressed in that order (e.g. 60/60/30).

NOTES:

- 1 In New Zealand the term ‘fire resistance rating (FRR)’ is used and has the same meaning as fire resistance level (FRL).
- 2 Where an FRL/FRR is required, reference should be made to the Building Code of Australia (BCA)/New Zealand Building Code (NZBC) for guidance.

1.4.23 Flammability

The potential to burn spontaneously or when ignited, or to produce flammable gas, vapour or dust either by decomposition or reaction

1.4.24 Freight container

An article of transport equipment that is—

- (a) of a permanent character and accordingly strong enough to be suitable for repeated use;
- (b) specially designed to facilitate the transport of goods, by one or other modes of transport, without intermediate reloading; and
- (c) fitted with devices permitting ready handling.

NOTE: The term ‘freight container’ does not include vehicles or packagings. However a freight container that is carried on a chassis is included.

1.4.25 Hazardous area

An area in which an explosive atmosphere is present, or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of potential ignition sources.

NOTES:

- 1 Examples of the classification of 'hazardous areas' are given in the AS/NZS 60079 series of standards.
- 2 (New Zealand) The HSNO Act uses the term 'hazardous atmosphere zones' however for the purposes of this Standard the term 'hazardous area' and corresponding definition should be used.

1.4.26 Hazardous Substance (New Zealand)

See definition for Dangerous Goods 1.4.14.

NOTE: For the storage and handling of substances, the HSNO Act uses the term 'hazardous substances'. For the purposes of this Standard the term dangerous good is synonymous with hazardous substance and both are used interchangeably throughout the document.

1.4.27 Hot work

The use or operation of any of the following:

- (a) Welding or flame cutting equipment.
- (b) Grinders, electric drills, electric cables, cords, switches, lights, connectors or fittings or other electrical equipment not suitable for use in hazardous areas.
- (c) Hot tapping equipment.
- (d) Spark ignition engines or non-approved compression ignition engines.
- (e) Matches, naked lights, cigarette lighters, flames or sparks.
- (f) Hand tools that could create a spark.
- (g) Any other thing that is likely to produce a source of ignition or be an ignition source.

1.4.28 HSNO Act

The *Hazardous Substances and New Organisms Act 1996* together with the Regulations, Group Standards and Transfer Notices made under that act.

1.4.29 Ignition source

A source of energy sufficient to ignite a flammable atmosphere. Ignition sources can include naked flames, hot surfaces, exposed incandescent material, electrical welding arcs, mechanical or static sparks, hot particles, electrical discharge, and electrical or mechanical equipment not suitable for use in hazardous locations.

NOTE: A vehicle is not regarded as being an ignition source while it enters or leaves a hazardous zone outside a package storage area for the purposes of loading or unloading packages, providing that the hazardous zone is not enclosed, or forms part of the package store.

1.4.30 Incompatible

In relation to dangerous goods or other goods, those that are—

- (a) likely to interact with the dangerous goods so as to increase the hazard when mixed or otherwise brought into contact with the dangerous goods; or
- (b) listed in the ADG Code/Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001 as being incompatible; or
- (c) declared by the regulatory authority to be incompatible.

A containment system (including a packaging, tank, bulk container or IBC) or equipment used for the transport or transfer of dangerous goods is incompatible with the goods if any component of the system or equipment that is intended or likely to come into contact with the substance during storage, handling, transfer or transport is—

- (i) likely to interact with the dangerous goods and increase risk because of the interaction; and
- (ii) not protected from contact under foreseeable circumstances by a protective coating or other effective means.

NOTES:

- 1 This definition should be read in conjunction with Clause 1.4.51.
- 2 Incompatible goods may be identified from the ADG Code/Hazardous Substances (Classes 1 to 5) Controls Regulations 2001 and from the relevant SDS.

1.4.31 Instability

The potential to undergo a spontaneous reaction (e.g. decomposition, polymerization), which could be violent.

1.4.32 Installation

All of those facilities on the site that are related to the storage and handling of the Class 4 dangerous goods.

1.4.33 Intermediate bulk container (IBC)

A rigid or flexible portable packaging for dangerous goods that—

- (a) has a capacity of not more than—
 - (i) 1500 L for solids of Packing Group I packed in a composite, fibreboard, flexible, wooden or rigid plastics container;
 - (ii) 3000 L for solids of Packing Group I packed in a metal container; and
 - (iii) 3000 L for solids or liquids of Packing Groups II and III;
- (b) is designed for mechanical handling;
- (c) is resistant to the stresses produced in handling and transport, as determined by tests; and
- (d) complies with the ADG Code/Part 6 of the *Hazards Substances (Tank Wagons and Transportable Containers) Regulations 2004*.

1.4.34 Material safety data sheet (MSDS)/Safety data sheet (SDS)

A document that provides information on the identification, health hazards, precautions for use and the safe handling of a specific chemical product, and complies with NOHSC:2011/Hazardous Substances (Identification) Regulations 2001 or HSNOCOP 8.

1.4.35 Minor storage (Australia only)

The storage of Class 4 dangerous goods in accordance with the criteria set out in Clause 2.2 of this Standard.

1.4.36 Non-combustible

Material that does not support combustion or is deemed non-combustible when tested in accordance with AS 1530.1/AS/NZS 1530.1.

1.4.37 On-site protected place

A building where people are employed within the property boundary of the installation, including warehouses, manufacturing or processing areas, amenities or other dangerous goods stores where quantities exceed minor storage.

The HSNO Act does not use the term 'on-site protected place' For the purposes of this Standard the term Area of High Intensity Land Use should be used.

1.4.38 Package

(Australia) The complete product of the packing of the goods, and consists of the goods and their packaging.

(New Zealand) A substance and the packaging in which it is contained.

1.4.39 Packaged dangerous goods

Dangerous goods that are—

- (a) in a container with a capacity of not more than 500 L; or
- (b) in a container that contains not more than 500 kg.

1.4.40 Packaging

(Australia) One or more receptacles, and any other components or materials necessary for the receptacles to perform their containment and other safety functions.

(New Zealand) Any receptacle, container or other material in which a substance may be encased, covered, enclosed, contained or packed, which performs part of the containment function; but does not include a freight container, a skip, a vehicle, a pallet or other article of transport equipment.

1.4.41 Packing group (PG)

One of three packing groups into which dangerous goods (of other than Classes 1,2,7 or Divisions 5.2 and 6.2) are designated in the ADG Code, in decreasing order of hazard, by the Roman numerals 'I' (high danger), 'II' (medium danger) and 'III' (low danger).

NOTE: The *UN Manual of Tests and Criteria* provides criteria for the assignment of Packing Groups. A list of those already assigned is given in the ADG Code/NZS 5433. Criteria for assignment of Packing Groups are also given in the ADG Code.

1.4.42 Pipework

An assembly of pipes, hoses, valves, fittings and associated appliances.

1.4.43 Port area

The land and sea area established by legislation

NOTE: Some port areas might overlap and legal requirements should take account of this possibility.

1.4.44 Practicable

Practical with regard to—

- (a) the severity of the hazard or risk in question;
- (b) the state of knowledge about that hazard or risk and any ways of removing or mitigating that hazard or risk;
- (c) the availability and suitability of ways to remove or mitigate that hazard or risk; and
- (d) the cost of removing or mitigating that hazard or risk.

1.4.45 Premises

The area under the control of the occupier.

1.4.46 Primary risk (Australia only)

The most significant hazard posed by the substance and is the hazard by which the substance is classified.

NOTE: The HSNO Act does not make a distinction between primary risk and subsidiary risks as all classifications are equally applicable.

1.4.47 Protected place

(Australia) Any of the following:

- (a) A dwelling, place of worship, public building, school or college, hospital, aged persons' accommodation, child-care facility, hospital, theatre, or any building or open area in which people are accustomed to assemble, whether within or outside the property boundary of the installation.
- (b) A factory, workshop, office, store, warehouse, shop or building where people are employed.
- (c) A ship lying at permanent berthing facilities.
- (d) Any storage facility for dangerous goods.
- (e) An environmentally sensitive area, which includes but is not limited to—
 - (i) a water catchment area;
 - (ii) a reservoir for drinking water;
 - (iii) a fresh water or marine environment; or
 - (iv) a national park or equivalent.

NOTE: The HSNO Act does not use the term 'protected place' (it uses the term 'Area of High Intensity Land Use' (HILU)), however for the purposes of this Standard, the term 'protected place' and corresponding definition should be used.

1.4.48 Public place

(Australia) Any place other than private property, open to the public, which the public has a right to use and which includes a public road.

NOTES:

- 1 Commercial building car parking areas are not considered public places.
- 2 The HSNO Act does not use the term 'public place' (it uses the term Area of Low Intensity Land Use (LILU)) however for the purposes of this Standard the term 'public place' and corresponding definition should be used.

1.4.49 Pyrophoric substances

Substances that, even in small quantities, are liable to ignite within 5 min after coming into contact with air.

1.4.50 Quantity

In relation to dangerous goods the quantity is measured as follows:

- (a) *Solid dangerous goods*—the mass in kilograms of the goods in a container or storage or handling system;
- (b) *Liquid dangerous goods*—the net capacity in litres of the container or storage or handling system;
- (c) *Solid dangerous goods that are not in a container*—the undivided mass in kilograms.
- (d) *Dangerous goods that are articles or things*—the net capacity of that part of the articles or things that in itself comprises dangerous goods

1.4.51 React dangerously

The reaction of substances in a manner that directly creates a hazard due to the reaction—

- (a) being violent;
- (b) producing an explosion;
- (c) producing a potentially explosive combination of products;
- (d) producing potentially dangerous quantity of toxic vapour or gas; or
- (e) producing a fire or rapid evolution of heat.

NOTE: This definition should be read in conjunction with the definition for ‘incompatible’.

1.4.52 Reactivity

The potential to react with other chemicals, water or fire extinguishing media.

1.4.53 Receptacle

A containment vessel for receiving or holding substances or articles, including any means of closing.

1.4.54 Regulatory authority

(Australia) The statutory authority responsible for the administration of control of the storage, transport and use of the Class 4 dangerous goods.

NOTE: More than one authority may be involved in relation to such matters (see Note 1 to Clause 1.2.1).

(New Zealand) The Environmental Protection Authority (EPA) administers the HSNO Act that places controls on the storage and use of hazardous substances of Class 1, 2, 3, 4, 5, 6, 8 or 9.

The NZ Transport Agency administers the *Land Transport Rule: Dangerous Goods 2005* which places controls on the transport of dangerous goods.

1.4.55 Restricted area

An area to which access is only available to persons authorized by the occupier.

A store for Class 4 dangerous goods is regarded as a restricted area.

1.4.56 Retail package

A package containing goods for individual sale, predominantly through retail shops.

NOTE: The term ‘retail package’ includes pre-packed articles and consumer commodities.

1.4.57 Risk management

The systematic application of management policies, procedures and practices to the following tasks:

- (a) Hazard identification (what can go wrong and why).
- (b) Risk analysis—comparing the anticipated risks of intervention with the risks of no intervention (how bad and how likely it is).
- (c) Risk assessment—a systematic process for the identification, analysis and evaluation of a substance, thing or event (a hazard) that could, under different circumstances, lead to an accidental loss or security breach (how acceptable it is).
- (d) Risk control (what can be done about it).

NOTE: AS/NZS ISO 31000 provides further information about risk management.

1.4.58 Screen wall

A structurally-sound wall that—

- (a) is impervious to liquid and vapour;
- (b) is constructed of materials that are substantially resistant to attack by the substances being kept; and
- (c) can act as a shield or deflection barrier.

1.4.59 Segregated

Isolated from each other within the store.

1.4.60 Segregation

The isolation of goods that are incompatible, or react dangerously, from each other within a storage area, by the use of physical barriers or distances within the same area.

1.4.61 Self-heating substances

Substances (other than pyrophoric substances) that, in contact with air and without an energy supply, are liable to self-heating. These substances will ignite only when in large amounts (kg) and after long periods of time (hours or days).

1.4.62 Self-reactive substances

Thermally unstable liquid or solid substances or mixtures liable to undergo strongly exothermic decomposition even without the participation of oxygen (air).

NOTE: This definition excludes substances and mixtures classified as explosives, organic peroxides, or oxidizing agents.

1.4.63 Separated

Isolated from the storage by a given minimum distance.

1.4.64 Separation

The isolation of dangerous goods storage areas from a protected place, a public place, premises boundaries, other dangerous goods storage areas, transport storage areas or transit storage areas.

1.4.65 Stationary tank

(New Zealand) A stationary container as defined in Schedule 8 of the Hazardous Substances Dangerous Goods transfer notice and schedule toxic substances.

1.4.66 Subsidiary risk (subrisk)

(Australia) A reference to any additional hazard that the dangerous goods might have, indicated by the Subsidiary Risk Number to which the dangerous goods are assigned. Dangerous goods have a Subsidiary Risk if they—

- (a) satisfy the criteria specified in the *UN Manual of Tests and Criteria* for their assignment to the Subsidiary Risk;
- (b) are assigned a Subsidiary Risk in the ADG Code; or
- (c) are assigned a Subsidiary Risk by the regulatory authority.

NOTE: (New Zealand) The HSNO Act does not make a distinction between primary risk and subsidiary risks, see Clause 1.2.5.

1.4.67 Supplier

An importer, manufacturer, wholesaler or distributor, but not a retail distribution centre or retail outlet.

1.4.68 Tank

(Australia) A receptacle in the form of a shell fitted with service equipment and structural equipment necessary to contain dangerous substances.

Tanks include fixed storage tanks, portable tanks, demountable tanks IBCs and cargo receptacles but do not include packagings.

The term 'tank' includes the following:

- (a) A static storage tank, intended to remain permanently in place once installed.
- (b) A demountable tank, which may be placed on a vehicle from time to time to enable its use as a temporary delivery tanker.
- (c) A cargo receptacles, which is fitted with frames to international freight container dimensions in accordance with AS/NZS 3711.6.

NOTE: This type of tank is also known as an 'ISO tank'.

- (d) A portable tank, including a shell fitted with service equipment and structural equipment necessary for the transport of dangerous substances.

A portable tank meeting this definition is capable of being loaded and discharged without the need to remove its structural equipment. It possesses stabilizing members external to the shell, and is capable of being lifted when full. It is designed primarily to be loaded in a transport vehicle or ship and is equipped with skids, mountings or accessories to facilitate mechanical handling.

- (e) IBCs as defined in Clause 1.4.32.

(New Zealand) A stationary tank or process container and its associated equipment, pipework and fittings, up to and including all transfer points as defined in Schedule 8 of the *Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004* (as amended).

NOTE: The HSNO Act uses the term 'stationary container', however for the purposes of this Standard, the term Tank is used throughout the document.

1.4.69 Toxicity

The immediate, delayed or long-term health effects on humans or animals, through inhalation, skin absorption or ingestion.

1.4.70 Transit storage

The storage of unopened containers of Class 4 dangerous goods, in accordance with the requirements of Section 4 of this Standard, held in transit for:

- (a) (Australia) Not less than 12 h and not more than five consecutive days, where such substances are intended for further transport to another location.

NOTE: For Class 4 dangerous goods that are desensitized explosives, check with the relevant state regulator for requirements on transit storage.

- (b) (New Zealand) More than—
 - (i) 18 hours, in the case of a substance that is not subject to tracking provisions of the *Hazardous Substances (Tracking) Regulations 2001*; or
 - (ii) 2 hours, in the case of a substance subject to the tracking provisions of those regulations; but

in no case more than 3 days.

1.4.71 UN Number

(Australia) The four-digit substance identification serial number assigned to dangerous goods by the United Nations Committee of Experts on the Transport of Dangerous Goods and listed for each substance or article in the ADG Code/NZS 5433.

NOTE: The UN Number may be found on the packaging of dangerous goods.

(New Zealand) The identification number assigned to dangerous goods by the United Nations Committee of Experts on the Transport of Dangerous Goods and as published in the latest edition of—

- (a) NZS 5433; or
- (b) *United Nations Recommendations on the Transport of Dangerous Goods—Model Regulations*; or
- (c) *International Maritime Dangerous Goods Code*; or
- (d) *Technical Instructions for the Safe Transport of Dangerous Goods by Air of the International Civil Aviation Organization*; or
- (e) *Dangerous Goods Regulations of the International Air Transport Association*.

1.4.72 Work permit

A written document that specifies the conditions under which work in a restricted area may be carried out.

1.5 PACKAGING REQUIREMENTS

Packagings to be filled with Class 4 dangerous goods shall—

- (a) for use other than at the premises at which it is to be filled, meet the requirements of the ADG Code/HSNO Act; and
- (b) for use at the premises at which it is to be filled, be constructed—
 - (i) with sufficient strength and durability for its proposed service; and
 - (ii) such that all components of the packaging that could be in direct contact with the contents are compatible with the contents.

1.6 LABELLING

Packages containing Class 4 dangerous goods shall be labelled in accordance with the appropriate Australian state or territory, or New Zealand legislation.

NOTE: In Australia, legislation may require labelling to comply with some or all of NOHSC: 2012, the ADG Code and the SUSDP.

1.7 SECURITY OF STORAGE AREAS

All storage areas shall be appropriately secured from access by unauthorized persons. The storage area shall be considered a 'restricted area'.

SECTION 2 HAZARD IDENTIFICATION AND RISK ASSESSMENT

2.1 SCOPE

This Section specifies that a documented hazard identification and risk assessment be carried out to provide the basis for appropriate controls to be identified for implementation. It also includes a number of items which, as a minimum, shall be considered in such an assessment. The intention is not that a risk assessment be limited only to those items listed here.

2.2 GENERAL

Due to the diverse range of properties and reactivity of substances, it is not possible in this Standard to prescribe detailed requirements for every situation involving storage and handling of any substance within Class 4. Hence, for safe management of Class 4 substances, a hazard identification and risk assessment specific to the substance/s and activities should be undertaken. However, where a prescriptive requirement is provided in this Standard, it shall be implemented in addition to any requirements arising from a hazard identification and risk assessment.

The detail required in a risk assessment can be great or small. It varies with the scale and complexity of the operations on the site, the inherent hazards presented by the substances and equipment used and the proximity of risk receptors to the hazard.

The hazard identification and risk assessment process should be conducted by a group of people with detailed knowledge of the substances, equipment and processes involved, and representing a broad spectrum of those involved with the facility, including technical specialists, operations staff, designers, management, and personnel with financial control of the project. It may be necessary to bring in additional personnel to provide adequate technical and operational knowledge and experience. Reference should be made to records of previous incidents onsite and elsewhere within and outside the organization to identify potential incidents.

A thorough assessment can help to detect and correct any potentially hazardous situations, and is best carried out using systematic methods including safety studies and check lists.

The following Clauses outline the hazards that shall be considered when planning or reviewing a storage and handling facility for Class 4 dangerous goods.

2.3 FACTORS TO BE CONSIDERED

When conducting a hazard identification and risk assessment for a storage or handling facility for Class 4 dangerous goods, the following features shall be considered:

- (a) The nature and quantities of the dangerous goods to be kept on the site, including:
 - (i) Fire risk and the potential for the substance to generate flammable or toxic gas or fumes, either by decomposition or reaction with other materials (e.g. fire fighting water or foam).
 - (ii) Reactivity and stability of the material (e.g. some substances decompose over time to pressurize containers. Some substances require specific storage and handling conditions such as humidity levels to ensure stability of the material.)
 - (iii) Container/vessel capacity (e.g. Storage and use of the material in multiple smaller quantities with separation rather than fewer larger ones may reduce the magnitude of worst case spills/fires and other incidents.)

- (iv) Minimizing the quantity of material involved in higher risk activities (e.g. smaller reaction vessels), risk may be reduced by separating main storage areas from processing/packing/blending and other handling activities where possible.
- (b) The manner by which the goods are to be stored or handled, including the type of equipment to be used (e.g. flameproof fork lift trucks), such as:
 - (i) Classification of hazardous zones associated with the substance and activities undertaken – whether they are due to flammable vapour, gas or dust hazards.
 - (ii) Potential ignition sources in hazardous atmospheres (e.g. lighting, mobile telephones, forklifts, fans, electric motors).
 - (iii) Potential for generation of static electricity in storage and handling systems (hoppers, cyclones, conveyors, pumping, transfer and packing systems etc.)
 - (iv) Potential for friction which may lead to ignition in systems such as conveyors and other materials handling equipment (e.g. augers, bearings).
 - (v) Potential for mechanical impact to systems and equipment containing or conveying the Class 4 dangerous goods.
 - (vi) Where combustible dusts may be generated, the potential for dust accumulation on horizontal surfaces. This can lead to secondary dust explosions in fires.
 - (vii) The potential for explosion in structures, vessels and plant in which flammable atmospheres may occur. This may lead to a requirement for explosion venting systems.
 - (viii) Compatibility of surfaces in contact with the dangerous goods with the substances they are used with.
 - (ix) Potential for contamination of the dangerous goods during handling or processing activities.
- (c) The operator's technical, operational, organizational and emergency procedures and safeguards for the storage and handling facility including:
 - (i) Substance and process specific operating procedures.
 - (ii) Substance and process specific training requirements for personnel.
 - (iii) Maintenance requirements, schedules and procedures to ensure the ongoing serviceability, reliability and safety of the equipment and facilities associated with the dangerous goods.
 - (iv) Emergency response systems, procedures, personnel, materials and equipment.
 - (v) Any requirement for specialized fire extinguishing or spill neutralization/absorbent materials. This shall be determined in liaison with agencies which may be required to respond to any incident at the site.
 - (vi) Any requirement for specialized emergency response equipment, including personal protective equipment (PPE) for emergency responders. This shall be determined in liaison with agencies which may be required to respond to any incident at the site.
 - (vii) Requirements and methods to notify persons and agencies internal and external to the site (including neighbours) of an emergency involving dangerous goods.
 - (viii) Adequacy and reliability of communication systems, including alarms.
 - (ix) Processes for recovery, quarantine, repacking and disposal of contaminated or spilled product.
 - (x) Permit systems (e.g. hot work, isolations).

- (xi) Segregation of incompatible materials.
- (xii) The process for monitoring of the effectiveness of controls and review of the risk assessment to ensure currency and validity.
- (d) Access to the storage or handling facility, including that required for normal transport operations, emergency response vehicles, and any evacuation routes, including:
 - (i) Ease of access and egress for vehicles and personnel in normal operations and for emergency response.
 - (ii) Lighting to allow clear access and egress.
 - (iii) Access to the dangerous goods within the storage or handling facility for emergency response (e.g. access may be impeded on high pallet racking or due to dense stacking of stock).
- (e) Surrounding land uses, population densities and proximity to other hazardous installations including:
 - (i) Potential for offsite persons to be affected by an incident involving the dangerous goods.
NOTE: This may require consequence modelling, particularly for potential off site plumes.
 - (ii) Ability to evacuate or protect in place for persons who may be affected.
 - (iii) Potential for other facilities to become involved in an incident involving the Class 4 dangerous goods (e.g. fire spreading to other dangerous goods facilities, on site explosion impacting off site facilities).
 - (iv) Potential off site effects from an incident involving the class 4 dangerous goods (e.g. road/rail closures, power isolations, evacuations).
 - (v) Proximity of environmentally sensitive areas to the facility.
 - (vi) Proximity to protected places and boundaries.
- (f) The interaction of the abovementioned factors.

2.4 HAZARD IDENTIFICATION

2.4.1 Hazards presented by the dangerous goods

The following hazards shall be considered when identifying hazards associated with a storage and handling facility for Class 4 dangerous goods.

- (a) Flammability.
- (b) Explosiveness (e.g. desensitized explosives).
- (c) Instability. This could pressurize or rupture containers or processing equipment.
- (d) Reactivity.
- (e) Toxicity—This may be a property of the substance itself, or of decomposition and reaction products.
- (f) Environmental impact, including ecotoxicity.
- (g) Corrosivity.

Further information may be obtained from product labels, MSDS, technical experts and the supplier of the substances.

2.4.2 Hazards presented by storage and handling conditions

The manner in which the dangerous goods are stored or handled shall be considered, including the following:

- (a) Storage and handling arrangements, including—
 - (i) the quantity of dangerous goods in each component of the storage and handling system;
 - (ii) whether the system is indoors or outside;
 - (iii) segregation of goods having different hazards;
 - (iv) pressure and temperature in storage and handling systems; and
 - (v) height of storage and handling systems.
- (b) The nature of packaging and containment systems used, such as:
 - (i) Paper and plastics packaging can be highly combustible.
 - (ii) The mechanical strength of the containers/process equipment is also important, as damage could lead to leaks and spills.
 - (iii) Design of bulk storage tanks, silos, and process vessels.
- (c) The design and construction of the storage and handling facility, fittings (e.g. lighting, drainage, ventilation, electrical wiring and heating).
- (d) Potential for failure of safety features of the facility, such as:
 - (i) Fire detection, alarm and suppression systems, evacuation routes, fire compartmentation, smoke management systems, explosion venting systems, emergency showers and eyewash units.
 - (ii) Means of secondary containment and recovery of spills, leaks and fire fighting runoff.
- (e) Activities within the storage and handling facility, including maintenance, handling, traffic movements, introduction of ignition sources and other potential causes of incidents.
- (f) Where water reactive substances are stored or handled, identification of potential water sources (e.g. stormwater, taps, emergency shower/eyewash units, fire hose reels) and how water comes in contact with the dangerous goods.

2.4.3 Hazards related to the work and external environments

The following hazards shall be considered:

- (a) The layout of the facility (structures and access ways) and its materials of construction.
- (b) Proximity of the store to nearby industrial plants, hazardous installations, other dangerous goods stores, or traffic.
- (c) Natural events, e.g. floods.
- (d) Extreme climatic conditions, e.g. high or low temperature or humidity. These could affect the integrity of packagings or the stability of the substances being stored.
- (e) Security of the store.

2.4.4 Process and handling analysis techniques

For processing and handling operations, there are a number of techniques which may be used in the hazard and risk assessment process. It may be appropriate to use one or more of them depending on the scale, nature and location of the operation in question. Some of these techniques are:

- (a) Hazard and Operability Studies (HAZOP).
- (b) Failure Modes and Effects Analysis (FMEA).
- (c) Fault tree analysis.
- (d) Event tree analysis.
- (e) Bow tie method.
- (f) Layer of Protection Analysis (LOPA).

NOTE: AS/NZS ISO 31000 provides further information on risk management; AS IEC 61882 provides further information on HAZOP.

2.5 RISK ASSESSMENT

2.5.1 Introduction

A risk assessment is a systematic approach to the analysis of what can go wrong in a system. The normal conditions of operation are defined, and then the following questions are asked:

- (a) What events (e.g. accidents, incidents) can occur?
- (b) How frequently can they occur?
- (c) What are the consequences of each event?
- (d) What are the total risks (i.e. the probability and consequence of events) of the system?
- (e) What is the significance of the calculated risk levels?
- (f) Are the risks acceptable?

These questions form the basic components of a risk assessment, whether it be qualitative, quantitative or semi-quantitative.

For large or complex installations, a full quantitative risk assessment (QRA) may be required. A QRA may also be appropriate where risk receptors such as off site populations are close to a facility and have been identified as being exposed to risk, to ensure the risk is acceptable and within prescribed or agreed criteria.

In other cases it may not be necessary to use absolute frequencies and risks, but it may be acceptable to assign relative risk rankings in a semi quantitative manner. This approach may be suitable for storage facilities in sparsely populated areas.

In any case, the risk assessment process should identify all credible hazards and identify means of controlling them to minimize risk to a tolerable level.

2.5.2 Objectives of risk assessment

The primary objectives of risk assessment can be summarized as follows:

- (a) Determine the risks generated by activities within the facility.
- (b) Establish the basis for identifying risk controls to be implemented.
- (c) Identify possible hazardous material emergencies which should be addressed in the emergency plan.

- (d) Provide a reference point against which progress towards better control of risks can be measured.
- (e) Provide the basis for a system to control the risk.

2.5.3 Risk analysis/assessment

Risk analysis/assessment involves the following basic steps:

- (a) System evaluation, in which information on the facility and the environment in which it operates, is collated and assimilated.
- (b) Hazard identification, in which events within and external to the store (which could lead to an incident involving the dangerous goods) are identified.
- (c) Frequency estimation, in which the likelihood of an event is estimated. This is often based on historical data.
- (d) Consequence assessment, in which all possible consequences of each event are estimated. For complex sites, or those in close proximity to sensitive areas, this may include consequence modelling such as plume modelling to identify the area and population potentially impacted by an event.
- (e) Risk evaluation, in which the assessed risk is compared against known standards to determine whether or not it is acceptable.
- (f) Identification of potential risk controls, in which potential additional risk controls or modifications to existing risk controls are identified.
- (g) Selection of risk controls, in which one or more additions or modifications to the existing set of risk controls are selected for implementation. Selection of risk controls may be aided by reference to other Sections of this Standard or to other accepted standards.

The risk assessment conclusions should clearly distinguish between uncontrolled risk and residual risk. For example, a quantity of flammable material may present a severe risk of fire if no controls are in place. Current controls may reduce the risk to some extent, but residual risk may remain unacceptable. Additional controls may be needed to further reduce the risk. The aim should be to minimize risk as far as reasonably practicable.

2.5.4 Risk control

If the risks are assessed as being unacceptable, risk controls shall be introduced or modified to reduce the risks to an acceptable level. Responsibilities, resources and timeframes shall be determined to ensure implementation of identified controls.

Selection of risk controls should 'where possible' follow the hierarchy of controls, in descending order of preference as follows:

- (a) Elimination of the hazard.
- (b) Substitution of a lower hazard alternative.
- (c) Isolation of the hazard.
- (d) Use of engineering controls.
- (e) Use of administrative controls.
- (f) Use of personal protective equipment (PPE).

Where the introduction or modification of risk controls has implications for other aspects of systems of work (e.g. the Emergency Plan), those implications shall be followed through thoroughly.

2.6 RISK REVIEW

The risk assessment shall be reviewed and if necessary revised when the following circumstances occur:

- (a) New hazardous materials are introduced to the site, or the quantities of hazardous materials are substantially increased.
- (b) New processes or activities involving or impacting on hazardous materials are introduced to the site.
- (c) Significant changes to personnel are made.
- (d) Significant changes to the work environment are made.
- (e) An incident occurs onsite or elsewhere which indicates that the current risk assessment may not be adequate.
- (f) A set period of time has passed since the risk assessment was conducted or last reviewed, e.g. five years.

SECTION 3 MINOR STORAGE (AUSTRALIA ONLY)

3.1 SCOPE OF SECTION

This Section specifies the criteria for minor storage of Class 4 dangerous goods, and the requirements for such storage for application in Australia.

Storage of Class 4 dangerous goods in quantities not exceeding those listed in Table 3.1 and complying with the requirements of this Section, may be classified as minor storage and are exempted from the other sections of this Standard except as required by this Section.

The storage of minor quantities of Class 4 dangerous goods under conditions that do not comply with the requirements of this Section, or of quantities of Class 4 dangerous goods greater than those given in Table 3.1, shall comply with the requirements of other relevant Sections of this Standard.

Minor storage may exist as a part of a premises or complex in which no other Class 4 dangerous goods in processes or storage.

NOTES:

- 1 Workplace safety regulations and guidelines may apply even to quantities defined as minor storage.
- 2 For liquids with subsidiary risks, or in areas where decanting, package filling or processing occur, additional safety precautions (e.g. ventilation), may be required. Guidance may be found in relevant exposure standards, MSDS and product labels.

3.2 MINOR STORAGE QUANTITIES

3.2.1 General

The quantities of Class 4 dangerous goods allowable as minor storage are given in Table 3.1.

3.2.2 Quantities of packing Group 1

Class 4 dangerous goods of PG 1, in containers larger than 2.5 L, shall not be kept in minor storage unless they are essential for daily operations and handled only by trained personnel.

3.2.3 Multiple minor storages

Where there is more than one minor storage on the same premises, such storages shall be separated by a distance of at least—

- (a) 20 m, if they are indoors; or
- (b) 15 m, if they are outdoors.

This distance shall be measured from the outermost package or tank in the minor storage (see Figure 3.1).

If two or more buildings are separated by at least 5 m of open space (i.e. an area without a roof and accessible for firefighting at all times), or by a concrete or double-brick wall capable of preventing the spread of a fire, a separate indoor minor storage quantity may be applied to each building.

3.2.4 Separation between minor storage and other stores

A minor storage shall be separated from any other store of Class 4 dangerous goods that is larger than minor storage by—

- (a) the distance to an on-site protected place (as given in Table 4.1); or
- (b) at least 5 m,

whichever is the greater.

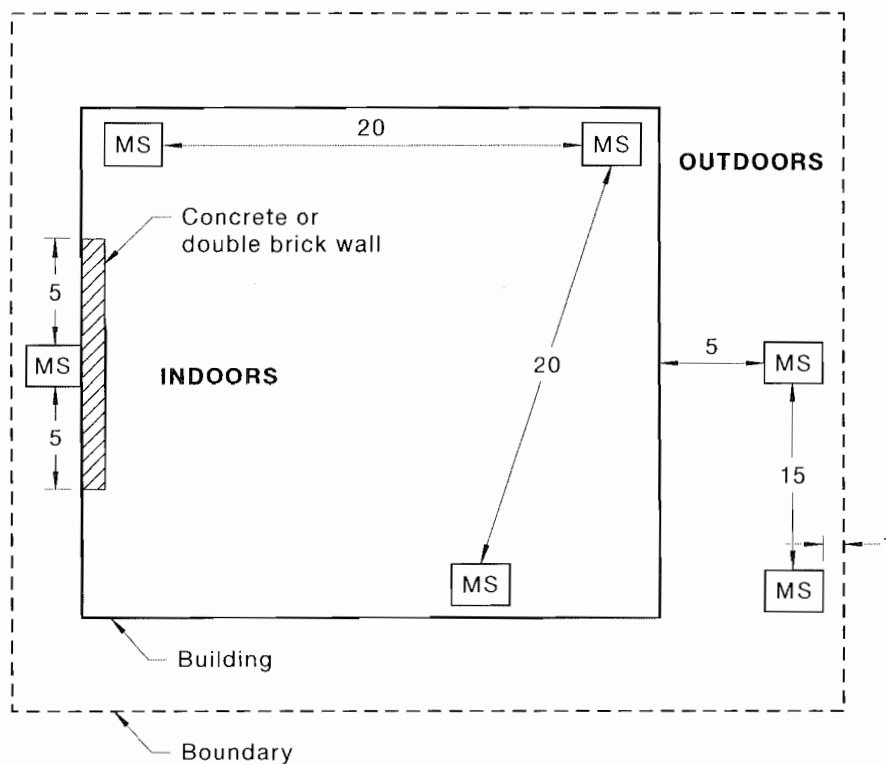
This clause (Clause 3.2.4) does not apply to storage cabinets (see Clause 4.7).

TABLE 3.1
MAXIMUM MINOR STORAGE QUANTITIES IN ANY 100 m² FLOOR AREA

Type of premises	Maximum quantity per 100 m ² floor area kg or L			
	Category A	Category B	Category C	Category D
1 Residential	0	0	1	5
2 Commercial building, hospital or educational establishment	0.5	2.5	5	10
3 Retail area	0	0	10	20
4 Laboratory, factory or workshop (except for those located within premises covered by 2 above)		5	10	20
5 Warehouse	5	10	20	40

NOTES:

- 1 Units of kilograms apply to solids and units of litres to liquids. The maximum quantities specified in terms of 'kg or L' are the sum of the number of kilograms (kg) of solids plus the number of litres (L) of liquids.
- 2 The total quantity of Class 4 dangerous goods of all categories should not exceed the maximum quantity specified for the least dangerous category being kept.
- 3 Categories of Class 4 dangerous goods are specified in Table 1.1.
- 4 Class 4 dangerous goods shall be in packages suitable for transport under the ADG Code and not more than 1 kg or L in capacity (Categories B and C) or 5 kg or L (Category D).
- 5 Security provisions for desensitized explosive substances may further restrict access and quantities permitted to be kept. Check with the relevant state regulator for additional requirements.

**LEGEND:**

MS = Designated minor storage areas

DIMENSIONS IN METRES

FIGURE 3.1 EXAMPLES OF LOCATIONS OF MINOR STORAGE

3.3 MINOR STORAGE REQUIREMENTS

The following requirements apply to the minor storage of Class 4 dangerous goods.

- (a) The store shall be an area or room of non-combustible construction.
- (b) Dangerous goods of Division 4.3 shall be kept away from—
 - (i) supplies of reticulated town water; and
 - (ii) storm water.
- (c) Adequate ventilation shall be provided for all storage and handling areas (see Clause 9.2.5).
- (d) Packages of Class 4 dangerous goods shall be kept at least 3 m from any foodstuffs, ignition sources, and other dangerous goods with which they are incompatible or may react dangerously.
- (e) Packages shall be kept cool, away from sources of heat.
- (f) Packages shall be kept securely closed when not in use.
- (g) Class 4 dangerous goods shall be used within their correct use-by date, or otherwise shall be disposed of in accordance with Section 12.
- (h) Where the dangerous goods are kept under water, they shall not be allowed to dry out.
- (i) Packages shall be kept in such a manner that avoids spillage.

- (j) Appropriate spillage-retention measures shall be provided at locations where packages are likely to be opened or their contents transferred.
- (k) The contents of a package shall not be transferred to any other container for storage unless the latter is suitable for the storage of the Class 4 dangerous goods and is clearly marked in accordance with Clause 1.6.

NOTE: Where the contents of the package have been transferred from another container, the resultant package, if it is to be used for transportation, is required by the relevant regulatory authority to comply with the ADG Code.

- (l) Static electricity shall be controlled in accordance with AS/NZS 1020.
- (m) Appropriate personal protective equipment, as specified in Clause 9.8.2, shall be worn by any person involved in product transfer operations.
- (n) Any spills or leaks shall be cleaned up immediately, and disposed of in accordance with Section 12.
- (o) Wastes shall be disposed of in accordance with Section 12.
- (p) Stores shall be placarded in accordance with regulatory requirements (see also Clause 10.4).
- (q) Suitable portable fire extinguishers of adequate capacity shall be provided in or near the store. They shall be installed in accordance with AS 2444.

Personnel shall be trained in the use of the fire extinguishers.

Where the nature of the Class 4 materials is such that the use of portable fire extinguishers is inappropriate, alternative fire fighting equipment shall be provided, along with training in its use.

NOTE: The manufacturer and relevant MSDS should be consulted for further advice.

SECTION 4 GENERAL REQUIREMENTS

4.1 SCOPE OF SECTION

This Section provides general requirements and recommendations that apply to the storage of Class 4 dangerous goods, in quantities greater than those classified as minor storage in Section 3. As Section 3 does not apply in New Zealand, see Table D1 of Appendix D for threshold quantities.

Additional requirements that are specific to particular types of installation are given in other sections of this Standard.

4.2 GENERAL DESIGN AND CONSTRUCTION AND OPERATIONAL REQUIREMENTS

4.2.1 Design safety and suitability

Any installation intended for the storage and handling of Class 4 dangerous goods shall be designed and constructed so that it is safe and suitable for the conditions of use. A risk assessment shall be undertaken as an element of the design process.

Factors that shall be considered include the following:

- (a) Working pressures and structural stresses.
- (b) Heat, corrosion, or attack by the substance being handled.
- (c) Site conditions such as topography, usage of adjoining areas, or the risk of natural disasters, e.g. flood, earthquake, lightning strikes.
- (d) Design of plant, equipment, piping and operating methods, so as to minimize fire and accident risks and the possibility of errors or misunderstanding by staff.
- (e) Specific design for emergencies (see Clause 3.2.2 and Section 11), particularly firefighting facilities.
- (f) The identification of the function of every valve, switch or control actuator, including any remote switches or actuators.
- (g) Safe access to and egress from all working locations.
- (h) Avoidance of ignition sources including static electricity.
- (i) Ventilation for vapour and dust dispersal, taking into account the possible effect of nearby structures, excavations, embankments, and the like.
- (j) Separation of potential hazards, including areas where activities cannot be controlled.
- (k) Points of vapour relief and explosion venting within buildings.
- (l) Spill control measures to avoid contamination of soil and water. Where dangerous goods can ignite on exposure to air, establish a method to contain any spillage so that air cannot come into contact with the spilt dangerous goods.
- (m) Incompatibility of materials.
- (n) Segregation of goods within the storage area.
- (o) The required separation distances to boundaries, buildings, and facilities both on and off site.
- (p) Packing and decanting areas.
- (q) Sufficient space to operate equipment such as forklifts, and to handle the day to day movement of goods.

- (r) Prevention of environmental contamination
- (s) Construction materials of walls, floors, ceilings, and handling equipment.
NOTE: Non-combustible, non-sparking materials should be used which are non-reactive with the materials stored.
- (t) Presence of store drainage system
- (u) Prevention of accumulation of dust within processing areas by all internal surfaces being readily accessible to facilitate cleaning. All walls should have a smooth finish and be sealed to prevent infiltration of dust

4.2.2 Operational requirements

Operations shall be conducted in accordance with the following:

- (a) Ensure high housekeeping standards. This is especially important for dangerous goods in powdered or granulated forms.
- (b) Ensure protection of dangerous goods from the weather, heat where they are sensitive to light, heat or temperature changes.
- (c) Ensure proper stock control measures are in place to avoid prolonged storage.
- (d) Ensure metallic powders are never stored in wet locations or where contamination with water is possible.
- (e) Ensure a routine inspection and testing regime is implemented where the stability of the dangerous goods relies on the presence of an inhibitor or stabilizer (e.g. desensitized explosives or wetted substances).
NOTE: Concentration of any inhibitor present should be checked often enough to ensure the concentration stays within the recommended levels set by the manufacturer.
- (f) Ensure a system is in place for containers containing wetted Class 4 dangerous goods, to be inverted gently as often as necessary to prevent the goods in the upper section of the container from drying out.

4.2.3 Emergency provisions

An installation shall be designed to facilitate the management of an emergency, taking into account—

- (a) the nature and quantity of the goods stored;
- (b) the layout of the storage area;
- (c) access through or around walls or other barriers;
- (d) the type of construction of any buildings; and
- (e) the type and means of operation of any fire protection system.

4.2.4 Hazardous areas

(Australia) A hazardous area shall not extend beyond a boundary.

(New Zealand) Each storage location shall be considered for the delineation of hazardous areas. A hazardous area must not extend beyond the boundary of the property at which the dangerous good is present unless the person in charge of any property beyond that boundary agrees that the hazardous area may be calculated to include the property of which the person is in charge. AS/NZS 60079.10 may be used to calculate the hazardous area delineation.

4.2.5 Separation distances

4.2.5.1 General

Storages shall be separated from boundaries, ignition sources, protected places and accumulations of combustible materials by the minimum distances relevant to each type of storage as specified in the relevant Clauses of this Standard, with the additional requirements and qualifications as set out in this Clause (4.2.5).

Where alterations to the installation or adjoining site result in a breach of the required separation distances, the installation shall be assessed and brought into compliance or decommissioned.

4.2.5.2 Separation to any property boundary and protected places

The separation distance to any property boundary and protected places shall be at least that distance required by—

- (a) for Australia, Table 5.1; and
- (b) for New Zealand, Tables 5.2 and 5.3.

4.2.5.3 Adjacent occupancies storing Class 4 dangerous goods

Where two adjacent premises under separate occupancies are each used for the storage and handling of Class 4 dangerous goods and share a common boundary, the separation distances between tanks, package stores and other buildings may be measured as though both premises were under a single occupancy, provided that a formal agreement or covenant is used and providing for the alteration, redevelopment or change of ownership of either site is in place.

4.2.5.4 On-site storage of other dangerous goods

The on-site storage of other classes of dangerous goods may require differing separation distances, as specified in the relevant Australian or New Zealand Standards or by legislation, or both. Where no such distances are specified, the storage containing the other dangerous goods should be considered as an on-site protected place and the relevant distance specified in this Standard applied.

4.3 ELECTRICAL INSTALLATIONS AND EQUIPMENT

The following requirements shall apply to both electrical equipment and installations in areas designated as hazardous areas under AS/NZS 60079:

(a) Electrical installations

All electrical installations shall be installed in compliance with the provisions of AS/NZS 3000 that relate to electrical equipment in hazardous locations. The equipment shall be of a type certified to comply with the relevant Australian or New Zealand Standard or that has been approved for use in such locations by the relevant authority.

(b) Portable and mobile electrical equipment

All electrical equipment to which AS/NZS 3000 does not apply shall be of a type certified to comply with the relevant Australian or New Zealand Standard or that has been approved for use in such locations by the relevant authority, except where Item (c) below applies.

(c) Electric forklift trucks

In hazardous areas classified as Zone 2, electric forklift trucks and similar vehicles (e.g. stackers) not suitable for use in the Zone shall not be used, except in New Zealand where Appendix D is complied with in all respects.

NOTE: Requirements for electric forklift trucks for use in hazardous zones are specified in AS 1915.

4.4 INTERNAL COMBUSTION ENGINES

Internal combustion engines may be used in hazardous areas under the following conditions:

- (a) An engine designed and certified to AS 2359 may be used in the zones for which it is certified. In such cases, a hot work permit is not required.
- (b) A spark ignition engine not complying with Item (a) may be operated in a hazardous zone if a hot work permit (see Clauses 9.5.3 and 9.5.6) has first been issued.
- (c) A compression ignition engine may be operated in a Zone 2 hazardous area if—
 - (i) any incorporated or attached electrical equipment is suitable for use in a Zone 2 hazardous area;
 - (ii) the air intake is either extended to outside the hazardous zone, or is provided with a strangler valve or equivalent in the manifold, in which case the engine is attended when in use;
 - (iii) mechanical sparks cannot be produced in the engine compartment of the appliance during its operation; and
 - (iv) the exhaust has a spark arrester complying with AS 1019 or is extended to outside the hazardous zone.

Any compression ignition engine not complying with AS 2359 (see Item (a) above) shall not be operated in a Zone 0 or Zone 1 area unless a hot work permit has been issued.

Forklift trucks and similar vehicles that are not approved for use in Zone 2, or that do not comply with Items (a) to (c) above, shall not be used unless a hot work permit has been issued.

4.5 LIGHTING

Lighting shall be provided in accordance with the following requirements:

- (a) During the hours of operation, lighting shall be sufficient to provide safe working conditions that include, but are not limited to, clear visibility of all markings on packages, signs, instruments and other necessary items.
NOTE: A minimum value of 50 lx is recommended.
- (b) Sufficient lighting shall be available on any of the installation's internal roads when personnel at the premises might use them.
- (c) Refer to Clause 4.3 which applies to lighting installations in hazardous areas.

4.6 RESTRICTED USAGE

A storage that has a capacity greater than that given for minor storage shall only contain Class 4 dangerous goods, unless the other products being stored will not react dangerously or be incompatible with the Class 4 dangerous goods.

If the store contains dangerous goods having a primary risk of other than Class 4, any other relevant New Zealand or Australian Standards or legislation shall be consulted and the more stringent requirement shall apply.

NOTE: (Australia) For Class 4 dangerous goods that are desensitized explosives, check with the relevant state regulator for restricted usage requirements.

4.7 FIREWALLS AND VAPOUR BARRIERS

4.7.1 Conditions of use

Separation distances may be measured in a horizontal plane around the end of any intervening vapour barrier, provided that the barrier complies with the following:

- (a) For separation from protected places and on-site protected places, such a vapour barrier shall be a firewall.
- (b) (New Zealand) For separation from public places, such a vapour barrier shall be a firewall with a minimum fire resistance level of 120/120/120.
- (c) Building walls may be treated as being firewall or vapour barriers provided that they qualify as such.

A wall on an adjacent property shall not be used as a firewall unless an agreement similar to that described in Clause 4.2.5.3 is in place.

Firewalls and vapour barriers may be used to achieve the separation distances in Tables 4.1, 5.2 and 5.3 to protected places, public places and boundaries.

4.7.2 Construction of firewalls

A firewall shall comply with the following requirements:

- (a) The fire resistance level shall be at least 240/240/240.
- (b) The firewall shall be impervious to vapour apart from around fire doors or other protected openings.
- (c) Any freestanding firewall shall be self-supporting and shall have adequate foundations.
- (d) The height of the firewall shall be sufficient to shield a protected place from heat radiation and flame impingement in the event that a potential storage fire becomes a reality, and vice versa.

NOTE: Where an FRL is required, reference should be made to the Building Code of Australia (BCA) or the New Zealand Building Code (NZBC) for building purposes.

4.7.3 Construction of vapour barriers

A vapour barrier shall comply with the following requirements:

- (a) The material shall be impervious to vapour and deemed to be non-combustible when tested in accordance with AS 1530.1/NZS/AS 1530.1.
- (b) The top of the vapour barrier shall be above the height of the hazardous area pertaining at that point as determined in the relevant part AS/NZS 60079.10.1.

4.8 EXPLOSION VENTING

Where Class 4 dangerous goods are stored in an enclosed storage area, and are capable of producing flammable gases, vapours or combustible dusts, appropriate explosion vents shall be provided in accordance with the following:

- (a) The explosion vent shall provide relief when the internal pressure exceeds 1 kPa gauge pressure.
- (b) An explosion vent may be a panel on a wall or free opening.
- (c) Explosion vents shall not be installed in a store that is enclosed within another building.
- (d) Each storage area within a building shall be separately vented.

- (e) Vents for fire and explosion relief shall be provided on an external wall, and have an area of at least;
 - (i) 0.1 m² for every 500 kgs stored; or
 - (ii) 1 m² for every 25 m³ of the storage area volume or part of 25 m³;
whichever is the greater.
- (f) The vent outlet shall be at least 8 metres from any door, window, other opening or fire escape, unless a blast resistant barrier screens the vent.

4.9 TEMPERATURE CONTROLS

Measures such as roof insulation and vents shall be provided in order to prevent heat build-up. The following storage requirements shall be observed:

- (a) Electrical equipment for cooling and temperature regulation shall be installed outside the store and at least 3 m from any opening to the store.
- (b) A means of temperature indication and a high temperature alarm shall be provided.
- (c) The maximum safe storage temperature shall be clearly indicated outside the store.
- (d) Dangerous vapours shall be prevented from building up inside the store.
- (e) Alternative cooling devices shall be activated if the normal cooling system fails.
- (f) If the control temperature is exceeded, any necessary repairs or increase in the cooling capacity of the system (e.g. by the addition of refrigerants), shall be carried out before the emergency temperature is reached.
- (g) Keyed switches or a keyed switch-box shall be used so that the store's electrical supply cannot be switched off.

4.10 SECURITY, SIGNS AND NOTICES

4.10.1 Control of access

All installations shall be appropriately secured against unauthorized access.

4.10.2 Signs and notices

At the entrance to any storage area greater than minor storage, the following signs shall be displayed:

- (a) A DANGER—NO SMOKING, NO NAKED FLAMES sign;
- (b) A Class label and Subsidiary risk label (if any).

The following signs should be placed at the entrance(s) to the premises:

- (i) A WARNING—RESTRICTED AREA, AUTHORIZED PERSONNEL ONLY sign.
- (ii) A sign listing the emergency contact names, titles and phone numbers relevant to the installation.
- (iii) The name, address and phone number of the occupier.
- (iv) A layout diagram showing the location of fixed fire protection facilities (where installed), the drainage system and the 'Emergency Stop' switch.

Where two or more points of access are adjacent to each other so that a single set of signs and notices are clearly readable from each point of access, duplicate signs and notices are not required.

(Australia) Signs shall comply with AS 1319. Class labels shall conform to AS 1216 and be a minimum of 250 mm square. Other signs shall have lettering at least 50 mm high.

(New Zealand) Signs shall comply with the *Hazardous Substances (Identification) Regulations 2001* or HSNOCOP 2.

NOTE: Composite signs or pictographs complying with the above requirements may be used.

4.11 TRANSIT STORAGE

4.11.1 General

This Clause (4.11) specifies requirements for the transit storage (as defined in Clause 1.4.70) of Class 4 dangerous goods.

Sections 1, 10 and 11 also apply to transit storage.

4.11.2 Delineation of transit storage areas

Areas used for transit storage of Class 4 dangerous goods shall be deemed separate areas if apart from each other and from any other storage areas, buildings or amenities by at least 15 m.

4.11.3 Requirements for transit storage

The following requirements apply to transit storage:

- (a) The aggregate quantity of Class 4 dangerous goods held in each transit storage area shall not exceed 200 t.
- (b) Except where in freight containers or on board trucks, the maximum aggregate quantity of goods in each pallet bank or store in a transit storage area shall not exceed 25 t. Such pallet banks or stores shall be at least 5 m apart, or separated by a firewall having an FRL of at least 120/120/120.
- (c) Dangerous goods shall be segregated in accordance with:
 - (i) (Australia) The ADG Code, as though they were to be loaded onto a vehicle.
 - (ii) (New Zealand) The Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001.
- (d) Parked road vehicles loaded with Class 4 dangerous goods shall be separated from each other by at least 3 m, and from any other dangerous goods stores by at least 5 m. Vehicles shall be parked so that they can be driven out of the site without recourse to reversing.
- (e) Freight containers or tank containers containing Class 4 dangerous goods in a transit storage area shall—
 - (i) not be stacked more than two containers high and two containers deep;
 - (ii) where stacked two containers deep, be provided with access for inspection to both sides of each stack;
 - (iii) not be in the same vertical stack as any container of any other Class of dangerous goods; and
 - (iv) be separated from containers of incompatible goods by at least 3 m.
- (f) Access and escape routes shall be clearly identified and kept clear at all times.
- (g) A spillage catchment and clean-up facilities shall be provided for the site. They shall be capable of handling at least 100% of the capacity of the largest tank, freight container, IBC or tanker compartment or 10% of the total packages in the area.

NOTE: In order to facilitate the management of emergencies, it is recommended that compound capacities be about 10% greater than the minimum values specified above.

- (h) The base of the transit storage area shall be sufficiently impervious to retain any spillage and to enable the recovery of any such spillage.
- (i) Appropriate facilities and materials shall be provided for the collection, containment and treatment of containers that are—
 - (i) leaking;
 - (ii) damaged and likely to leak as a result of such damage; or
 - (iii) awaiting disposal.

NOTES:

- 1 A designated area may be provided for such containers.
- 2 Packages of goods that are leaking, or are impaired and might spill or leak, should not be loaded onto a vehicle unless in a waste recovery container.
- (j) Except in emergencies, dangerous goods shall not be transferred between containers or decanted in a transit storage area.
- (k) Where relevant, and in emergencies, appropriate protective equipment shall be provided and used.
- (l) (Australia) All dangerous goods and freight containers shall be marked in accordance with the ADG Code.
- (m) (New Zealand) The labelling of all dangerous goods stored in a transit depot and freight containers must comply with the Land Transport Rule, Dangerous Goods 2005.
- (n) Transit storage areas shall be kept clear of any extraneous matter.
- (o) No ignition sources shall be brought into or located within any hazardous zone in the transit storage area

4.11.4 Separation distances for transit storage areas

Areas for transit storage shall be separated from protected places, on-site protected places, boundaries and public streets by the minimum distances given in Tables 5.1, 5.2 and 5.3 for the aggregate quantity of dangerous goods stored.

Transit storage areas shall be separated from any accumulation of combustible material, e.g. stacks of timber or plastic pallets, by at least 5 m.

All of the above separation distances shall be measured from the edge of the transit storage area.

4.12 IGNITION SOURCES

A vehicle shall not be regarded as an ignition source while it is entering or leaving a hazardous zone surrounding a bulk transfer connection for the purposes of loading or unloading bulk Class 4 dangerous goods. However it shall be treated as a potential ignition source during any period of the bulk transfer, and the precautions given in Section 9 of this Standard shall apply.

A vehicle shall not be regarded as an ignition source while it is entering or leaving the hazardous zone outside a storage area for the purposes of loading or unloading Class 4 goods, provided that the hazardous zone is not enclosed and the vehicle is not within the storage area. During the loading and unloading, the vehicle's engine shall be switched off and shall not be started. Any vehicle shall not enter the storage area unless—

- (a) it is suitable for the applicable hazardous zone as given in AS/NZS 60079; or
- (b) a hot work permit has been issued (see also Clause 3.4).

Handling operations, which could lead to ignition of Division 4.1 dangerous goods, e.g. activities capable of generating a spark, heat, friction, impact, shock or flame, shall not be carried out within 8 m of where Division 4.1 dangerous goods are being handled or stored.

4.13 STORAGE IN TANKS

4.13.1 Tank materials, design and construction and operation

The following requirements apply to the design, construction and operation of tanks:

- (a) (Australia) Steel tanks that are intended to be operated at atmospheric pressure, or at pressures of not more than 100 kPa (gauge) shall be designed and constructed in accordance with the relevant requirements of AS 1692, API Standard 620, API Standard 650 or other equivalent Standard.
- (b) (Australia) Steel tanks intended to be operated at pressures above 100 kPa (gauge) shall be designed and constructed in accordance with AS 1210 or other equivalent Standard.
- (c) (New Zealand) Tanks shall be constructed in accordance with the provisions of Schedule 8 of the *Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004*.
- (d) (New Zealand) Tanks that are intended to be operated at a pressure exceeding 50 kPa shall be designed and constructed in accordance with the provisions of the *Health and Safety in Employment (Pressure Equipment, Cranes, and Passenger Ropeways) Regulations 1999*.
- (e) The materials of construction of the tank, its fittings and attachments shall be compatible with the substance that is to be stored in it.
- (f) Tanks shall be designed to prevent moisture from entering the tanks
- (g) Valves and fittings shall be located to ensure that they are readily accessible and easily operated as designed
- (h) Tank inlets and outlets shall be fitted with remote operated primary shut off valves at the tank and automatic closing shut off valves in the event of fire
- (i) All tanks, hoppers and pump systems shall be designed so that the risk of introducing foreign materials into the process is minimized.
- (j) Portable bulk containers shall be adequately restrained during lifting.
- (k) Venting provisions on portable bulk containers shall be operational at all times.
- (l) All liquid shut-off valves on demountable tanks shall be closed prior to the tank being disconnected from the shut off system.
- (m) (Australia) The filling and transport of portable bulk containers shall be carried out in accordance with the ADG Code/NZS 5433 and, where applicable, the IMDG Code.
- (n) (New Zealand) The filling and transport of portable bulk containers shall be carried out in accordance with the Hazardous Substances (Tank Wagons and Transportable Containers) Regulations 2004/NZS 5433 and, where applicable, the IMDG Code.
- (o) Storage vessels for sulphur shall be provided with explosion protection. This may be in the form of explosion venting, an explosion suppression system; or the use of an inert gas (e.g. nitrogen or carbon dioxide) to reduce the oxygen content below the explosive limit.

NOTE: The systems should be assessed for Safety Integrity Level (SIL) and designed accordingly under AS/IEC 61511 series of Standards.

4.13.2 Requirements on pumps

All sites where pumps are used for the transfer of Division 4 dangerous goods shall have a documented pump selection, operating and maintenance management system. The system shall include the following requirements:

- (a) All pump applications, limitations, classifications and safety protection systems shall be defined in an engineering safety review and shall be authorized for use with the technology involved and the chemicals or materials used in the process.
- (b) Each pump shall be uniquely identified and a logbook maintained for each.
- (c) A program shall be established to document general and specified inspections, corrective maintenance and major repairs.
- (d) All internal or external components of a pump utilized in the process shall be manufactured from materials that are compatible with the chemicals used.
- (e) Pump protection systems defined in the engineering safety review shall be tested to a documented procedure on a regular schedule. Pump protection systems shall be able to detect and prevent dead heading and dry operation of the pump.

NOTE:

Examples of pump protective devices are—

- 1 thermofuse/temperature trip at pump inlet, midpoint or outlet;
 - 2 over-pressure and under-pressure trip close to the pump;
 - 3 bursting disc;
 - 4 drive torque limiting devices;
 - 5 drive speed limiting devices;
 - 6 feed hopper level control;
 - 7 no flow detection; and
 - 8 time out or countdown automatic shut-down system.
- (f) A pump incident report system shall document any abnormal condition such as no flow, excessive heat, and the like, and identifying the causes, operating conditions and corrective actions implemented to prevent a similar incident from occurring.
 - (g) Pumps shall be monitored by approved personnel during operation.

4.13.3 General tank separation distances

Where dangerous goods of Class 4 are suitable for storage in tanks, (except as specified below) the following separation distances shall apply:

- (a) Dangerous goods of PG I and II in tanks shall be separated by at least 30 m from any—
 - (i) protected places and boundaries;
 - (ii) other dangerous goods stores; or
 - (iii) other substances with which they may be incompatible or may react dangerously.
- (b) Dangerous goods of PG III in tanks shall be separated by the separation distance given: for Australia in Table 5.1, or for New Zealand in Tables 5.2 and 5.3, or by the diameter size of the tank, whichever is greater.

Reduced separation distances may be applied if they are supported by a risk assessment but the separation distance specified in Items (a) and (b) shall be considered first.

(Australia) The reduced separation distances shall not be less than 15 m in the case of PG I or PG II dangerous goods.

(New Zealand) The reduced separation distances shall not be less than the distances specified in Table 5.2 or 5.3 or in the case of PG II or PG II dangerous goods 15 m whichever is greater. In all cases, the requirements of Regulation 79 of the Hazardous Substances (Classes 1 to 5) Controls Regulations must be complied with

4.13.4 Separation distances and spillage containment for elevated temperature liquids in tanks

Elevated temperature liquids in above-ground tanks shall be separated by the greater of the distance specified in 4.13.3 or the following distances:

- (a) At least 15 m from protected places and public places.
- (b) At least 10 m from any—
 - (i) on-site facilities not directly connected with the storage or handling of the substances;
 - (ii) dangerous goods stores other than for elevated temperature substances or if a greater distance is specified elsewhere ;
 - (iii) accumulations of flammable or combustible materials; or
 - (iv) goods or equipment which could be significantly affected by heat exposure (e.g. pressure vessels and piping).

Spillage containment for rapidly solidifying liquids (e.g. molten metal) may be achieved by kerbing or guttering rather than by a bunded compound. Any method of spillage containment shall ensure compliance with the provisions of Items (a) and (b) above.

The effects of heat radiation on the surrounding area shall be considered, as follows:

- (i) Heat protection shall be provided to persons, other dangerous goods, combustible materials, gas cylinders, pressure equipment or other goods or equipment that might be affected by heat exposure.
- (ii) Where effective heat shielding is used, reduced separation distance may be considered if supported by risk assessment but not less than 3 m. Greater distances (of up to 15 m) should be considered first.

4.14 BUNDS AND COMPOUNDS FOR TANKS

4.14.1 Requirements

Where liquids of Class 4 are kept in tanks, provision shall be made to contain any leakage or spillage from the tank storage facility and to prevent it from contaminating the surrounding soil or from entering any watercourse or water drainage system.

Any such above-ground tank shall be installed within a compound complying with the requirements of this Clause (4.14).

4.14.2 Capacity

The net capacity of the compound shall be at least the capacity of the largest tank in Australia, or at least 110% in New Zealand. If two or more tanks are operated as a single unit, then the capacity of all such tanks shall be used when calculating the capacity of the compound.

Where there is an onsite firefighting capability, the capacity of on-site containment shall be increased to include the output of any fire media over a 20 min period.

4.14.3 Design and construction

A compound and its bund shall comply with the following requirements:

- (a) It shall be sufficiently impervious to retain spillage and enable recovery of any such spillage.
- (b) The bund shall retain its structural integrity in a fire situation.
- (c) Any bund or compound floor shall be designed to withstand the hydrostatic head when full.
- (d) A bund shall not be higher than 1.5 m above interior grade unless a means of safe entry and exit is provided.
- (e) Any pipe that passed through the bund shall be designed to prevent excessive stresses due to settlement or expansion resulting from fire exposure. The joint between the pipe and the bund shall be sealed to prevent leakage.
- (f) The location of the bund relative to the closest tank shall be such that the top inside perimeter of the bund is not inside the crest locus limit as shown in Figure 4.1.
- (g) (Australia) The distance from the top inside perimeter of the bund to protected places or on-site protected places shall be at least half of the specified separation distance given in Table 5.1.
- (h) (New Zealand) The distance from the top inside perimeter of the bund to areas of protected place use and areas of public place use shall be at least half of the specified separation distances given in Tables 5.2 and 5.3.
- (i) The material used to construct the bund, associated equipment and any other structure within it, shall be non-reactive to the goods being stored. If this is not possible, it shall be coated to prevent contact

NOTES:

- 1 It is preferable to have moderately high bunds, rather than shallow bunds, in order to minimize the surface area that can burn in a fire.
- 2 Consideration should be given to access between groups of bunded area for emergency vehicle access.

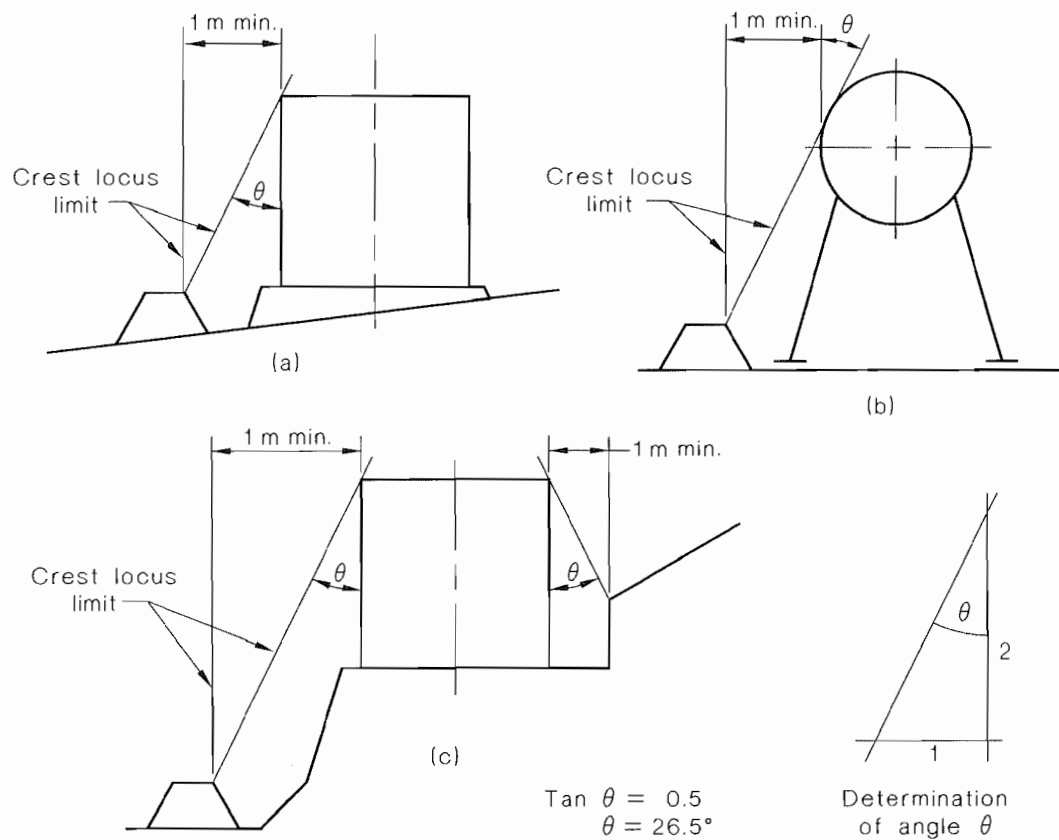


FIGURE 4.1 BUND LOCATION LIMITS FOR BULK LIQUID STORAGE

SECTION 5 PACKAGE STORAGE AND HANDLING AREAS

5.1 SCOPE OF SECTION

This Section sets out general requirements for the storage and handling of packaged Class 4 dangerous goods, in quantities greater than those classified as minor storage in Section 2.

NOTES:

- 1 Sealed intermediate bulk containers (IBCs) having a capacity not exceeding 1500 L may be stored and handled in the same manner as packages in accordance with this Section.
- 2 Further specific requirements and recommendations for the storage and handling of various types of Class 4 dangerous goods are given in subsequent sections of this Standard.
- 3 Specific requirements for the bulk storage of specific Class 4 dangerous goods are given in the relevant sections of this Standard.

5.2 TYPES OF STORES

A storage area for packaged Class 4 dangerous goods may be, but is not limited to, any of the following:

- (a) Open air storage, if appropriate.
- (b) A free-standing, roofed building.
- (c) A room or roofed area external to another building but attached to an external wall of that building.
- (d) A room or area within a building, one wall of which is part of the external wall of the building.
- (e) A fire-resistant storage cabinet.

5.3 PLANNING AND DESIGN

When planning a storage area for packaged Class 4 dangerous goods, the following factors shall be addressed:

- (a) The type and quantity of dangerous goods being stored.
- (b) The required separation distances to boundaries and other buildings and facilities, both on- and off-site.
- (c) The segregation of goods within the storage area.
- (d) Special facilities such as decanting and repacking areas.
- (e) Sufficient space to operate equipment such as forklifts, and to handle the daily movement of goods.
- (f) Safe entry to and exit from all work locations.
- (g) Prevention of environmental contamination, including soil and water.
- (h) Sufficient space between bund walls, storage areas and other structures, to allow access for maintenance and during emergencies.
- (i) A means of reducing emissions to the atmosphere.
- (j) Electrical installation sufficient to supply the required number of electrical power points (general purpose outlets), welding outlets, light fittings and other power requirements.

- (k) Fire protection equipment.
- (l) A means of evacuation.
- (m) Protection of personnel responding to an emergency.
- (n) Containment of leaks, spills and run-off, including any blocking-off of drains and drainage systems.
- (o) The location of the emergency plan (see Clause 10.2.2) and safety information (see Clause 10.4.2).
- (p) Sufficient space for parking vehicles.
- (q) Any local government zonings or other ordinances.

NOTES:

- 1 (Australia) Some state and local authorities require plans for facilities storing dangerous goods to be assessed or approved before construction is commenced.
- 2 (New Zealand) Requirements of the HSNO Act apply to buildings for the storage of hazardous substances.

5.4 SEPARATION AND SEGREGATION

5.4.1 Class 4 dangerous goods having subsidiary risks

Where the Class 4 dangerous goods being kept have one or more subsidiary risks, reference shall be made to the relevant Australian or New Zealand Standards or New Zealand Legislation for the classes of those risks and the greatest specified separation and segregation distances shall apply.

5.4.2 Separation

5.4.2.1 General

Unless otherwise specified elsewhere in this Standard, the requirements for separation given in this Clause (Clause 5.4.2) apply.

5.4.2.2 Separation of stores from protected places and boundaries

With due regard being given to Clause 5.4.1, stores of packaged Class 4 dangerous goods shall be separated from protected places and boundaries by at least the distances set out in Table 5.1, 5.2 or 5.3. Specific separation distances for other stores for Class 4 dangerous goods are given in the appropriate Section.

Where more than 200 tonnes of Class 4 dangerous goods are stored in Australia, or more than 500 tonnes are stored in New Zealand, separation distances shall be determined by risk assessment. Records of such risk assessment shall be made and kept.

NOTE: Guidance on risk analysis to assess alternative safety practices is provided in Appendix C of this Standard and in AS/NZS ISO 31000.

5.4.2.3 Measurement of separation distances

Separation distances may be measured horizontally around an intervening screen wall if the following requirements are met.

- (a) Either—
 - (i) where the height of the store is greater than or equal to that of the protected place, the wall shall extend at least 1 m above the highest package in the store; or
 - (ii) where the height of the store is less than that of the protected place, the wall shall extend at least 1 m above the protected place or extend as a roof above the store.

- (b) The wall shall be marked to indicate the maximum permissible storage height.
- (c) The walls and roof (if any) shall have a fire resistance level (FRL)/fire resistance rating (FRR) of at least 240/240/240.

NOTE: Where an FRL/FRR is required, reference should be made to the Building Code of Australia (BCA)/New Zealand Building Code (NZBC) for guidance.

5.4.2.4 *Separation from foodstuffs*

Unless otherwise specified in the additional requirements for particular substances, stores of Class 4 dangerous goods shall be separated by at least 5 m from any—

- (a) foodstuffs;
- (b) containers for foodstuffs;
- (c) products for human or animal consumption or application; and
- (d) medical or veterinary materials.

5.4.2.5 *Separation from ignition sources*

Stores of Class 4 dangerous goods shall be separated from ignition sources in accordance with the following requirements:

- (a) Where the Class 4 dangerous goods are kept in a fire-resistant storage cabinet, they shall be separated from any potential ignition source by at least 3 m.
- (b) Where the Class 4 dangerous goods are capable of producing flammable gas, the requirements of AS/NZS 60079 series shall apply.
- (c) All other stores of Class 4 dangerous goods shall be separated from any potential ignition sources by at least 8 m.

5.4.3 Segregation of Class 4 dangerous goods

5.4.3.1 *Segregation from substances that are incompatible or might react dangerously*

Stores of packaged Class 4 dangerous goods, other than those in fire-resistant storage cabinets, shall be segregated from incompatible goods and goods with which they might react dangerously in accordance with the following requirements:

- (a) They shall be segregated by at least 5 m when kept in closed containers.
- (b) They shall be segregated by at least 8 m where containers are opened or where manufactured.
- (c) They shall be kept in separate compounds that do not share a common drainage system.

5.4.3.2 *Measurement of segregation distances*

The distances specified in Clause 5.4.3.1 may be measured horizontally around an intervening screen wall if the following requirements are met:

- (a) The wall shall extend at least 1 m above the highest package in the store.
- (b) The wall shall be marked to indicate the maximum permissible storage height.
- (c) The wall shall have an FRL/FRR of at least 240/240/240.

NOTE: Where an FRL/FRR is required, reference should be made to the Building Code of Australia (BCA)/New Zealand Building Code (NZBC) for guidance.

Where used, bunds shall comply with Clauses 5.3(h) and 5.6 of this Standard.

Where packaged Class 4 dangerous goods are kept with other goods that are compatible and do not react dangerously with them, the two storage areas should be discrete, for housekeeping reasons.

TABLE 5.1 (Australia)
**MINIMUM SEPARATION DISTANCES FOR PACKAGE
 STORES FROM PROTECTED PLACES AND BOUNDARIES**

Aggregate quantity kept kg or L	Minimum distance from protected places and boundaries, m			
	Category A	Category B	Category C	Category D
> minor storage ≤ 250	10	5 (See Note 4)	4 (See Note 4)	3 (See Note 4)
> 250 ≤ 2000	16	10	6	6
> 2 000 ≤ 20 000	20	12	10	6
> 20 000 ≤ 60 000	25	16	12	8
> 60 000 ≤ 200 000	30	20	16	10
> 200 000	Determined through semi- quantitative risk assessment	Determined through semi- quantitative risk assessment	Determined through semi- quantitative risk assessment	Determined through semi- quantitative risk assessment

NOTES:

- 1 Categories of Class 4 dangerous goods are given in Table D1.
- 2 These distances shall be used only for Class 4 dangerous goods with heat of combustion less than 45 MJ/kg. For dangerous goods with higher heat of combustion, separation distances need to be calculated on a case-by-case basis.
- 3 Where Class 4 dangerous goods of differing Categories are kept in the one store, the distances shall be—
 - (a) those applicable to the most dangerous Category present; and
 - (b) based on the aggregate quantity of Class 4 dangerous goods being kept.
- 4 For quantities between minor storage quantities and 250 kg or L, storage cabinets are likely to be the most cost-effective option; in which case, Clause 4.7 applies. Note that, under Clause 4.7.7(e), the aggregate capacity of cabinets shall be not greater than 250 kg or L per 250 m². If a package store is used instead of cabinets, Clause 4.5 applies (and Clause 4.6 where necessary). In either case, the whole of this standard applies where relevant, with the exception of Section 3 (Minor Storage).
- 5 Where separation distances are specified in Sections 6, 7 or 8, those separation distances shall take precedence over those in Table 5.1.
- 6 For quantities in between those specified, distances may be interpolated and rounded up to the next integer.
- 7 Where the Class 4 dangerous goods are kept within a bunded compound, the separation distance shall be measured from the top inside perimeter of the bund.
- 8 Separation distances to on-site protected places that are an integral part of the storage, handling or processing of the Class 4 dangerous goods may be reduced, subject to appropriate risk identification, assessment and control.
- 9 A general administration building or other unrelated manufacturing, process or handling area is not considered an integral part of the storage and handling of Class 4 dangerous goods.
- 10 When quantities exceed manifest quantities, regulations may require that the relevant regulator be notified.

TABLE 5.2 (New Zealand)
MINIMUM SEPARATION DISTANCES FOR PACKAGE STORES FROM
PROTECTED PLACES AND BOUNDARIES

Aggregate quantity kept kg or L		Minimum distance from protected places and boundaries, in m			
		Category A	Category B	Category C	Category D
≤2 000		16	10	6	6
>2 000	W10 000	20	12	10	6
>10 000	W100 000	25	16	12	8
>100 000	W500 000	30	20	16	10
>500 000		As determined by risk assessment in accordance with Section 2 of this Standard			

NOTE: See Notes to Table 5.3.

TABLE 5.3 (New Zealand)
MINIMUM SEPARATION DISTANCES FOR PACKAGE STORES
FROM PUBLIC PLACES

Aggregate quantity kept kg or L		Minimum distance from Public Places, in meters			
		Category A	Category B	Category C	Category D
≤2 000		8	5	3	3
>2 000	W10 000	10	6	5	3
>10 000	W100 000	12.5	8	6	4
>100 000	W500 000	15	10	8	5
>500 000		As determined by risk assessment in accordance with Section 2 of this Standard			

NOTES:

- Categories of Class 4 dangerous goods are given in Table D1.
- Where Class 4 dangerous goods of differing Categories are kept in the one store, the distances shall be—
 - those applicable to the most dangerous Category present; and
 - based on the aggregate quantity of Class 4 dangerous goods being kept.
- Where the Class 4 dangerous goods are kept within a bunded compound, the separation distance shall be measured from the tank.
- Separation distances to on-site protected places that are an integral part of the storage, handling or processing of the Class 4 dangerous goods may be reduced, subject to appropriate risk identification, assessment and control.
- A general administration building or other unrelated manufacturing, process or handling area is not considered an integral part of the storage and handling of Class 4 dangerous goods.
- The appropriate authority for land use, e.g. the local council, may stipulate greater separation distances than those given above.

5.5 CONSTRUCTION OF PACKAGE STORES

5.5.1 General

Package stores for Class 4 dangerous goods, other than fire-resistant storage cabinets, shall comply with the following general requirements:

- Stores shall be located on a ground floor that has immediate access for emergency personnel.

- (b) At least two means of access shall be provided to stores which have a floor area exceeding 25 m².
- (c) Stores shall be designed, constructed and operated in a manner that will allow the housekeeping requirements of Clause 9.3 to be carried out effectively.
- (d) Stores shall have wall and roof sheeting and main structural members constructed from materials that are non-combustible and resistant to attack by the material being stored.
- (e) Lighting shall comply with Clauses 4.5 and 9.2.4.
- (f) Adequate natural or mechanical ventilation shall be provided for all storage and handling areas (see Clause 9.2.5).

Where mechanical ventilation is required, it shall comply with AS 1668.2/NZS 4303.

- (g) Stores shall be provided with a means of containing a spill (see Clause 4.14).
- (h) All areas used for decanting shall have floors that are capable of containing a spill or of diverting it to a suitable compound within the boundaries of the premises.
- (i) Packages shall be kept in a manner such that they cannot fall and cause spillage outside the compound.
- (j) Stores shall be secured against unauthorized entry, in accordance with Clause 1.7.
- (k) Where provided, and except where they are designed as spill trays or compounds, racks or shelves shall be designed and constructed in such a manner as to prevent the accumulation or pooling of liquid.
- (l) Where racking is used, the layout of racks shall be such as to provide clear passage for escape of personnel. Racks used in connection with the storage of packages shall be:
 - (i) Constructed of material compatible with the dangerous good;
 - (ii) Structurally sound and designed for the maximum load to which they are subjected; and
 - (iii) Designed to permit ready access to the packages of dangerous goods.

Racking shall be designed to be sufficiently strong to carry the anticipated loading when fully loaded. The permitted loadings shall be indicated by signage placed on the racking.

Where there is the possibility of impact by vehicles, impact protection shall be provided for the racking.

- (m) Where a package store is adjacent to another building, forms part of another building, or is enclosed by another building, the package store shall be separated from that building by walls having a fire rating of at least 240/240/240. The ceiling and floor shall have a fire rating of at least 180/180/180.

The doors connecting the store to the other building shall have a fire resistance rating of at least:

- (i) (Australia) -/240/30.
- (ii) (New Zealand) -/120/60.
- (n) Doors to a package store shall not open inwards.

NOTES:

- 1 It is recommended that the width of aisles between racks be at least 1.2 m.
- 2 Where packages are stored on pallets, sufficient clear manoeuvring space should be made for forklifts, in accordance with the forklift manufacturer's specification.

- (o) Where packages are kept in stacks, the stacks shall be arranged in such a manner as to minimize the possibility of stack collapse and to prevent damage to packages in lower layers from loadings exerted by the upper layers.

When containing dangerous goods of Class 4, drums of 205-litre capacity (whether on pallets or not) shall be stacked no more than three high and IBCs shall be stacked no more than two high.

- (p) In stores and associated handling areas where combustible dusts or flammable vapours may be generated a hazardous area may exist; all electrical and other equipment in any such hazardous areas shall be suitable for use in those zones.
- (q) The following items shall be provided in stores where packages are opened:
 - (i) A safety shower and eye-wash facilities, both complying with AS 4775.
 - (ii) Water for the washing of hands.

Except for Division 4.3 or subsidiary risk 4.3 these facilities shall be located within 7 m of, but not nearer than 2 m to, the store.

Where dangerous goods of Division 4.3 or subsidiary risk 4.3 are stored or used, the locations of the safety shower, eye-wash facilities and water shall be located as determined by risk assessment, taking into account the hazards associated with the water-reactive properties of the dangerous goods.

- (r) Any lunch room or area for eating and drinking shall be separate from the storage area. Lockers for storing personal clothing and property shall be located away from the storage area.
- (s) Freight containers shall not be used for the storage of Class 4 dangerous goods unless they are suitably designed or modified to comply with the requirements of this Standard.

If appropriate, where the package store does not have walls, the roof shall be sufficiently large to protect the goods from direct rays of the sun, and the rain.

5.5.2 Electrical installations

The following requirements shall apply to electrical equipment where Class 4 dangerous goods are stored:

- (a) The requirements of AS/NZS 60079 series, AS/NZS 61241 series and AS/NZS 3000 apply as appropriate to the nature of the dangerous goods being kept.
- (b) Unless otherwise specified elsewhere in this Standard, any electrical equipment within the compound shall be suitable for use in a Zone 1 hazardous area.

5.6 BUNDS AND COMPOUNDS

5.6.1 Spillage containment

Provision shall be made to contain any leakage or spillage within the premises, and to prevent them from contaminating surrounding soil or from entering any drainage system (other than any intended for their drainage and collection).

If the Class 4 dangerous goods are liquid, contain a liquid or are molten, the spill collection compound shall be designed to contain:

- (a) (Australia) At least 100% of PG I and PG II; and 25% of PG III. In any case, the capacity of any compound shall be at least the capacity of the largest container kept.
- (b) (New Zealand) See Table D2 of Appendix D for quantities.

In any case, the capacity of any compound shall be at least the capacity of the largest container kept.

Where an automatic fire sprinkler system is installed, the compound capacity shall be increased by a volume equal to the output of water or foam at rated capacity over a 20 minute period (see AS 2118/NZS 4541).

NOTE: In order to assist the management of emergencies, it is recommended that compound capacities be about 10% more than the minimal capacities specified above.

5.6.2 Design and construction of compounds

A compound shall comply with the following requirements:

- (a) It shall be sufficiently impervious to retain and enable the recovery of any spillage.
- (b) The bund shall be designed to withstand the hydrostatic head when full.
- (c) The bund shall not be higher than 1.5 m above interior grade unless means for safe and rapid entry and exit are provided.

NOTE: Consideration should be given to access between groups of bunded areas for emergency vehicles.

5.6.3 Storage of packages in bunded compounds

Packages containing Class 4 dangerous goods shall be set back from the inner edge of the bund by a distance equal to half the height of the stack or one metre, whichever is greater.

5.7 STORAGE IN CABINETS

5.7.1 General

This Clause (Clause 4.7) applies to the storage of Class 4 dangerous goods in cabinets.

Class 4 dangerous goods that are incompatible or react dangerously with each other shall not be kept in the same cabinet.

5.7.2 Maximum quantities to be kept

The maximum capacity of a cabinet in which Class 4 dangerous goods shall not exceed 250 kg or L.

No cabinet shall hold more than 25 kg or litres of Category A, 50 kg or L of Category B or 100 kg or L of Category C.

NOTE: Units of kilograms (kg) apply to solids and units of litres (L) to liquids.

5.7.3 Cabinet design and construction

The following requirements and recommendations apply to the design and construction of cabinets:

- (a) The walls, floor, door and roof shall be of double-walled sheet steel construction, having a thickness of at least 0.75 mm, with a space at least 40 mm between the walls. This space shall be either airspace or filled with non-combustible insulation.
- (b) Cabinets shall be provided with a self-closing, close-fitting door. The door shall be held shut by either a friction-type or a magnetic-type lock, which shall release in the event of a build-up of pressure within the cabinet.
- (c) Any gaps around the doors and into the space between the walls shall be sealed as far as is necessary to prevent the spread of flame or heat radiation.
- (d) The cabinet bottom shall form a liquid-tight compound at least 150 mm deep capable of containing at least the contents of the largest container and shall be designed to prevent the compound from being used as a storage space.
- (e) Any shelves within the cabinet shall be perforated to permit free air movement, and shall be capable of supporting the maximum possible load.
- (f) All leakage shall be directed into the lower compound.

- (g) The materials of any components that are critical to the cabinet's structural integrity shall not melt at temperatures of less than 850°C. Seals or gaskets are excepted but their use should be avoided if their failure could affect the protective function of the cabinet.

5.7.4 Cabinet marking

Each cabinet shall be marked with—

- (a) the name and address of the manufacturer or, for imported cabinets, the distributor within Australia/New Zealand;
- (b) the maximum storage capacity;
- (c) the relevant dangerous goods division label with sides of at least 250 mm nominal length; and
- (d) a sign bearing the words 'NO SMOKING, NO IGNITION SOURCES WITHIN 3 m' in lettering at least 50 mm high.

All signs and markings shall be clearly visible when the cabinet doors are closed.

5.7.5 Ventilation of cabinets

Where ventilation is installed the design of any vent opening in the cabinet wall shall not compromise the structural strength of the cabinet.

Where a toxic or flammable gas could be emitted, ducting shall be designed in such a manner as to prevent back-pressure and shall be directed away from ignition sources and areas where people congregate.

NOTE: Ventilation provisions should be designed by an appropriately qualified person.

5.7.6 Location of cabinets

The following requirements apply to the location of cabinets:

- (a) Cabinets shall be located so that they do not impede access or egress in an emergency or obstruct ventilation systems.
- (b) Other than for cabinets containing minor storage quantities, storage in cabinets shall only be on floors that have direct access from street or ground level.
- (c) Except when used to store Division 4.3 dangerous goods, cabinets shall be located near to a provision for the washing of hands.
- (d) The aggregate capacity of cabinets shall not be greater than 250 L in any 250 m² on any floor. Each aggregate quantity shall be separated by at least 10 metres.
- (e) Where a cabinet is located outdoors, it shall be provided with adequate protection against weather, corrosion and traffic damage.

5.7.7 Exclusion of ignition sources

There shall be no ignition sources within the cabinet.

Ignition sources shall be excluded from the area outside the cabinet to a distance of 3 m, measured laterally, and from floor level to a height of 1 m above any opening into the cabinet, including the door opening. Alternatively, the extent of the Zone may be calculated and classified according to the provisions of AS/NZS 60079 and AS/NZS 61241 series.

5.7.8 Storage in cabinets

The following operational requirements and recommendations apply:

- (a) Persons shall be prevented from entering the cabinet.
- (b) Drums shall not be stacked more than two high if they are greater than 60 L capacity.

- (c) Only one drum of more than 60 L capacity should be kept in a horizontal (decanting) position at any time.
- (d) Only closed packages, or those fitted with a tap, should be stored in the cabinet.

5.8 STORAGE OF IBCs

Intermediate bulk containers (IBCs) of up to 1500 L capacity may be stored in a package store provided that—

- (a) they are not connected to any piping or product delivery system;
- (b) the ventilation and spillage control provisions are adequate to cater for the volume of IBCs being stored;
- (c) the IBCs are stored at least 1 m from the bund or edge of the store, unless splash shields or baffles constructed from compatible, non-combustible materials are used;
- (d) they comply with the ADG Code in Australia or with *UN Model Regulations* Chapter 6.5 in New Zealand; and
- (e) the IBCs are not stacked more than two high unless purpose-built racking is provided.

5.9 STORAGE IN FREIGHT CONTAINERS

Except when loading and unloading, or whilst in transit storage, freight containers shall not be used for the storage of packaged Class 4 dangerous goods unless they have been modified to comply with the requirements of this Section of this Standard with regard to separation, segregation, ventilation and spillage containment.

The following additional requirements apply to the storage of Class 4 dangerous goods in freight containers:

- (a) A freight container shall not be used as both a storage area and a workshop area.
- (b) The floor of the freight container shall be made of a material compatible with the Class 4 dangerous goods proposed to be stored.
- (c) Before the freight container is first used as a store, the floorboards shall be inspected for any significant contamination from previous spills or leaks.
NOTE: Contaminated floorboards could react dangerously with any further spills or leaks, or evolve harmful vapours in a fire.
- (d) Where pedestrian access is required, there shall be passageway at least 800 mm wide inside the freight container. This passage shall be clearly delineated, e.g. by yellow lines painted on the floor.
- (e) No electrical equipment shall be installed inside the freight container unless it is suitable for use in the hazardous zone.
- (f) Each door of the freight container shall be able to be opened from the inside. Any external locks shall be deactivated.
- (g) No point within the freight container shall be more than 6 m travel distance from the freight container's exit door.

5.10 PACKAGE FILLING OPERATIONS

The following requirements apply to package filling operations:

- (a) Ventilation shall be provided sufficient to maintain concentrations of vapours and dusts at safe values, as required by regulations, and shall comply with the requirements of AS 1668.2/NZS 4303.

NOTE: The extraction system may require a scrubber prior to venting to atmosphere.

- (b) Prior to commencement of any filling operation, all associated filling equipment shall be cleaned free of any residues of substances that are incompatible or that could react dangerously with the product being used in the filling operation.
- (c) Where Class 4 dangerous goods are supplied from a tank, an emergency shut-off device shall be fitted to the package-filling equipment. The emergency shut-off device shall be—
 - (i) clearly marked with its function and method of operation;
 - (ii) capable of operation from two points, one immediately adjacent to, and one remote from the filling point; and
 - (iii) capable of stopping the flow of product into any containers associated with the filling operation.
- (d) The transfer of Class 4 dangerous goods from one container to another shall be conducted in a dedicated area away from the storage area.
- (e) The package filling area shall be capable of containing a spill.
- (f) No active or potential ignition source shall be introduced to the package filling area without authorization, e.g. by means of a work permit (see Clause 8.5.3).
- (g) (New Zealand) Reference shall be made to the *Health and Safety in Employment Act*.

5.11 ACTIVITIES IN PACKAGE STORES

Activities other than those mentioned in Clause 4.10 shall not be carried out in the package storage area unless a risk assessment has been carried out and a risk management plan prepared and implemented.

Such a plan shall specify the conditions under which the activities can be carried out without significantly increasing the level of risk (e.g. of ignition, fire or explosion) or creating new hazards (e.g. vapour release).

NOTE: Approval from the regulator may be required to undertake other activities in package store.

5.12 OFFICES WITHIN PACKAGE STORES

Where an office is located inside a store for Class 4 dangerous goods, the following requirements shall apply:

- (a) The office shall only be used for activities that are directly associated with the store's operation.
- (b) The office shall be regarded as a restricted area.
- (c) The office shall be provided with a means of escape that is not through the area where the dangerous goods are stored.
- (d) Office walls and roof shall have at least 1 hour fire resistance rating. All office windows facing the store shall be of shatterproof glass, e.g. toughened safety glass or safety wired glass.
- (e) Personnel working in the office shall not be exposed to any vapours from the store.
- (f) Where a hazardous area (assessed in terms of AS/NZS 60079.10.1) extends into the office (e.g. through a door, window or other opening), the relevant requirements for ignition sources in hazardous areas shall apply.

SECTION 6 ADDITIONAL REQUIREMENTS FOR DIVISION 4.1 DANGEROUS GOODS

6.1 SCOPE OF SECTION

This Section sets out specific requirements for the storage and handling of dangerous goods of Division 4.1, including desensitized explosives and nitrocellulose. These requirements are additional to and take precedence over those specified elsewhere in this Standard.

6.2 APPLICATION OF SECTION

This Section applies to dangerous goods of Division 4.1.

Clause 6.3 applies in general to substances of Division 4.1.

Clause 6.4 applies to desensitized explosives and nitrocellulose stored in fire resistant cabinets.

Clause 6.5 applies to storage of packages and IBCs for dangerous goods of Division 4.1 with special reference to desensitized explosives and nitrocellulose.

Clause 6.6 applies to desensitized explosives.

Clause 6.7 applies to desensitized explosives and nitrocellulose.

Clause 6.8 applies to storage of self reactive substances.

6.3 GENERAL

Division 4.1 includes the following types of substances:

- (a) *Flammable solids*, readily combustible solids and may cause fire through friction.
- (b) *Self reactive substances*, thermally unstable substances and liable to undergo a strongly exothermic reaction or decomposition even without participation of air.
- (c) *Solid desensitized explosives*, substances that are wetted with water or alcohols or are diluted with other substances to form a solid mixture to suppress their explosive properties. Solid desensitized explosives may explode if not diluted sufficiently.

(Australia) Entries for solid desensitized explosives can be found in the Class 4 Dangerous Goods List in Appendix A.

6.4 STORAGE IN INDOOR FIRE-RESISTANT CABINETS

6.4.1 General

The requirements of this Clause (6.4) apply to the storage of desensitized explosives and nitrocellulose, in addition to the requirements of Clause 5.7.

6.4.2 Maximum quantities to be kept

An indoor fire-resistant cabinet shall contain not more than 125 kg, unless it is divided into two compartments, each with a door, and separated by a steel partition, in which case each compartment may contain up to 125 kg.

6.4.3 Ventilation provisions

Each cabinet or compartment shall be ventilated to outside the building. Each vent shall be—

- (a) at least 250 cm² in area;
- (b) constructed of steel at least 1.5 mm thick; and
- (c) insulated to provide an FRL/FRR of at least 120/120/120.

6.5 STORAGE OF PACKAGES AND IBCs

Where substances of Division 4.1 are stored, the following requirements and recommendations apply:

- (a) Packages shall be stored—
 - (i) in an indoor fire-resistant cabinet; or
 - (ii) in an indoor store having at least one external wall.
- (b) Solid chemicals should preferably be stored on upper shelves above liquid chemicals.
- (c) Shelving shall be compatible with the goods stored.
- (d) Secondary containment is essential for large containers. Any container of capacity 2.5 L and above should be provided with secondary containment.
- (e) Any electrical equipment in the store shall be suitable for use in a Zone 1 hazardous area, as designated in the AS/NZS 60079 series; and installed in accordance with the requirements of AS/NZS 3000.

The following additional requirements apply to the storage of desensitized explosives, desensitized explosives containing nitrocellulose (UN 2555, 2556 and 2557) and fibres or fabrics with weakly nitrated cellulose (UN 1324, 1353, 2000 and 3270):

- (i) Packaging containing these substances shall be UN-approved containers or equivalent, or of metal construction, and fitted with close-fitting metal lids.
- (ii) The maximum quantity of substance kept in a single package shall be 100 kg.
- (iii) The floor shall be constructed of non-sparking material.
- (iv) Packages shall be stacked not more than two high, with a suitable material placed between them to prevent their contact with each other.
- (v) Where the store is part of, or attached to, another building, the quantity of desensitized explosives or nitrocellulose stored shall not exceed 2000 kg.

NOTE: A list of UN Numbers and Proper Shipping Names for these substances is given in Appendix A.

6.6 SEPARATION DISTANCES FOR DESENSITIZED EXPLOSIVES

Desensitized explosives may have extra restrictions upon separation distances, access and quantities allowed to be stored due to security provisions. Consult with your state regulator for any additional requirements.

6.7 OTHER SPECIAL REQUIREMENTS FOR DESENSITIZED EXPLOSIVES AND NITROCELLULOSE

6.7.1 Storage and handling of desensitized explosives

Special considerations are necessary when storing and handling desensitized explosives and nitrocellulose substances.

When storing and handling these materials, the following shall apply:

- (a) Electrical installations or equipment shall not be installed unless absolutely essential, in which case they shall comply with Clause 4.3(a) of this Standard
- (b) Where dust and vapour hazards are likely to occur simultaneously, then a dual classification for equipment may be necessary.

NOTE: In such cases, equipment acceptable under each of the two classifications should be chosen.

- (c) Ignition due to thermal effects shall be avoided. This is achieved by assigning a temperature classification to the equipment based on the maximum surface temperature that the apparatus can reach under normal or fault conditions.

NOTE: For equipment using exclusion or explosion containment as a type of protection, the temperature is measured on the external surface. For equipment using energy limitation or avoidance of ignition source, the temperature is measured on surfaces inside the equipment.

- (d) Nitrocellulose and desensitized explosive products that are unpackaged, contaminated, or no longer wetted or in specification shall be handled and treated as an explosive of Class 1.
- (e) Quantity of desensitized explosive in any one location shall be kept to the absolute minimum consistent with production, process, testing or delivery requirements. Where cinematographic film is repaired, manipulated or used, up to 600 m for each person working on the film may be present.
- (f) All nitrocellulose products shall be removed from the work area immediately after completion of work.
- (g) When containers are stacked consideration shall be given to critical height and effective vent areas of packages.
- (h) Desensitized explosives shall never to be exposed to direct sunlight or other strong artificial light.
- (i) All desensitized explosive shall be identified as to type, batch or lot number.
- (j) Desensitized explosives shall be stored with due regard to compatibility with other explosive items.
- (k) Desensitized explosives which degrade with time shall be regularly tested for chemical stability with appropriate disposal action taken as necessary
- (l) Stocks shall be regularly examined to ensure that safe storage conditions are maintained e.g. that wetted explosive materials are not drying out etc.
- (m) Packages which are damaged or leaking, illegibly marked, insecurely sealed or fastened, or which appear to be otherwise defective shall not be placed or taken into a store area until the defect has been rectified.
- (n) No work other than labelling and identification of packaging shall be carried out in a store for desensitized explosive.
- (o) Storage areas shall be designed and equipped so that the inside temperature remains within the range of product specification or manufacturer's recommendation.
- (p) Sensitive explosives material shall be desensitized before disposal. Special procedures for this practice should be developed.
- (q) When specifying equipment, the potential for generation and collection of electrostatic charges by polymeric or plastic materials and for the striking of sparks from metal surfaces shall be considered. Exclude plastic items in these cases if possible but if they are necessary then the type of plastic shall be appropriately specified.
- (r) Non-sparking rather than non-ferrous materials shall be specified. Only copper or copper alloys shall be accepted as non-sparking.

NOTE: Aluminium in violent contact with rusted steel can produce quite significant sparking. Similarly, sparks can be produced from impact on steel that is coated with aluminium paint.

6.7.2 Security

Desensitized explosives shall be regarded as accountable items and any evidence of attempted forced entry to, or theft of stock or an unaccountable stock discrepancy shall be immediately reported to the police or other appropriate authority in accordance with regulation. Inventory records shall be readily available to permit the determination of the type and quantity of missing desensitized explosives.

NOTE: Check with the relevant state regulatory authority for any additional reporting requirements for desensitized explosives.

6.7.3 Nitrocellulose manufacture and use

6.7.3.1 General

Where more than 25 kg of any nitrocellulose product is manufactured or used, the requirements of this Clause (5.5) apply in addition to those of Clause 5.2.

6.7.3.2 Work areas

Any work area shall—

- (a) be constructed of fire-resistant materials;
- (b) have at least two doors, which open outwards;
- (c) be so arranged so as to have no impediments to the egress of its occupants;
- (d) contain signs bearing the words NO SMOKING, SPARKS, FLAMES OR IGNITION SOURCES in letters at least 50 mm high; and
- (e) have an appropriate automatic fire sprinkler system installed.

NOTE: The automatic fire sprinkler system needs to be of appropriate rating and design for the intended scale, layout and nature of the work to be undertaken in the work area.

6.7.3.3 Electrical equipment

Electrical resistances, including heating elements, shall be guarded or enclosed so that they cannot cause ignition or decomposition of the nitrocellulose products, by means of—

- (a) positioning so as to ensure that they cannot heat to more than 100°C; and
- (b) sloping the top of the guard or enclosure to an angle of at least 45° to the horizontal.

6.7.3.4 Waste nitrocellulose products

Waste nitrocellulose products shall not be allowed to accumulate in the work area but shall be collected at frequent intervals. They shall be placed in a strong metal container fitted with a self-closing lid and marked with the words 'HIGHLY FLAMMABLE WASTE' in letters at least 50 mm high and the appropriate dangerous goods Division and Subsidiary Risk label.

6.8 SELF REACTIVE SOLIDS AND LIQUIDS

Operating parameters for self reactive materials storage facilities shall be monitored and controlled (i.e. oxygen level, humidity or moisture, pressure and temperature).

SECTION 7 ADDITIONAL REQUIREMENTS FOR THE STORAGE AND HANDLING OF DIVISION 4.2 DANGEROUS GOODS

7.1 SCOPE OF SECTION

This Section sets out specific requirements for the storage and handling of Division 4.2 dangerous goods. These requirements are additional to or take precedence over those specified elsewhere in this Standard.

Division 4.2 includes:

- (a) Pyrophoric substances, which are substances, including mixtures and solutions (liquid or solid) which can ignite within five minutes of coming in contact with air. These are the Division 4.2 substances which are the most liable to spontaneous combustion; and
- (b) Self heating substances which are substances other than pyrophoric substances, which in contact with air and without energy supply are liable to self heating. These substances will ignite only when in large amounts and after long periods of time may lead to self ignition and combustion.

7.2 APPLICATION OF SECTION

This Section applies to dangerous goods of Division 4.2.

Clause 7.4 applies to Storage of packages and IBCs

Clause 7.5 applies to dangerous goods of Division 4.2 of Packing Group I and II in tanks

7.3 GENERAL REQUIREMENTS

7.3.1 Handling and storage

When handling or storing Division 4.2 dangerous goods the following factors and requirements shall be considered and complied with:

- (a) Metallic powders shall not be stored in wet locations or where contamination with water is possible.
- (b) Pyrophoric materials shall not be stored in flammable storage vaults or flammable storage cabinets or with other flammable and combustible materials.

7.3.2 Agricultural products in Division 4.2

Some fibrous material containing oil falls into Division 4.2. Typical examples are cotton meal and some types of animal fodder, including by-products of oil extraction such as seed cake.

Examples are:

- UN 1364 Oily cotton waste, including cotton hulls and lint from cotton gins
- UN 1363 Copra (dried coconut kernels)
- UN 1373 Fibres, animal or vegetable with oil
- UN 1374 Fish meal (fish scrap) unstabilized (Class 9, UN 2216 if stabilized)
- UN 1386 Seed cake, if more than 1.5 per cent oil and up to 5 per cent, and not more than 11 per cent moisture (classified as UN 1373 if more than 5 per cent oil content)
- UN 2217 Seed cake, if not more than 1.5 per cent oil and not more than 11 per cent moisture
- UN 3088 Self-heating solid, organic, not elsewhere specified.

7.4 STORAGE OF PACKAGES AND IBCs

The following requirements apply to all stores of Division 4.2 dangerous goods, in quantities exceeding those allowed as minor storage:

- (a) Where the store is part of, or attached to, a building that is used for other purposes, not more than 2500 kg of Division 4.2 dangerous goods shall be stored.
- (b) All electrical equipment for use in the store shall be suitable for use in a Zone 1 hazardous area, as designated by AS/NZS 60079.10 series, and installed in accordance with the requirements of AS/NZS 2381.
- (c) Packages of Division 4.2 dangerous goods shall be stored—
 - (i) in an indoor fire-resistant cabinet; or
 - (ii) in an indoor store having at least—
 - (A) one external wall; or
 - (B) one open, external side.
- (d) Packaged stores for Division 4.2 dangerous goods (PG I and PG II) shall be separated from stores of foodstuffs, protected places and boundaries by at least 15 m.

7.5 STORAGE TANKS FOR DIVISION 4.2 PG I AND PG II DANGEROUS GOODS

7.5.1 General

The following requirements apply to tanks in which dangerous goods of Division 4.2 PG I or PG II are stored:

- (a) The tank shall be a pressure vessel conforming to AS 1210.
- (b) Tank inlets and outlets shall be fitted with remote shut-off valves which close automatically in the event of fire.
NOTE: The systems should be assessed for Safety Integrity Level (SIL) and designed accordingly under the AS IEC 61511 series of Standards
- (c) Tanks shall be designed and operated to prevent the entry of moisture.
- (d) Where there is more than one tank in a compound, that compound shall be constructed so that any spillage is drained to a catchment area sufficiently remote from the tanks, to ensure that the tanks are not affected by any fire in the catchment area.
- (e) The storage area shall be paved with concrete.

7.5.2 Separation distances between tanks for metal alkyls or metal alkyl halides

Tanks containing metal alkyls or metal alkyl halides shall be separated by at least 12 m from any other tanks containing dangerous goods of Division 4.2, PG I.

SECTION 8 SPECIAL REQUIREMENTS FOR DIVISION 4.3 DANGEROUS GOODS

8.1 SCOPE OF SECTION

This Section sets out requirements for the storage and handling of Division 4.3 dangerous goods. These requirements are additional to and take precedence over those specified elsewhere in this standard.

8.2 APPLICATION OF SECTION

This Section applies to dangerous goods of Division 4.3.

Clause 8.4 applies to the storage of packages and IBCs.

Clause 8.5 applies to dangerous goods of Packing Group I.

Clause 8.6 applies to dangerous goods of Packing Group II.

Clause 8.7 applies to dangerous goods of Division 4.3, Subsidiary Risk 3.

8.3 ESSENTIAL REQUIREMENT

Division 4.3 dangerous goods shall be protected from exposure to water in any form, including atmospheric moisture. In achieving this, the design, construction and operation of the storage situation shall take into account possible emergency or non-routine scenarios as well as routine operations.

8.4 STORAGE OF PACKAGES AND IBCs

8.4.1 General

The following additional requirements apply to stores for Division 4.3 dangerous goods in packages or IBCs, where the containers are not opened within the store:

- (a) Where the store is part of a building either of the following applies:
 - (i) At least one side shall be an external wall with ventilation to the outside of the building and no ventilation into the building. Ventilation shall be designed and constructed to prevent ingress of water.
 - (ii) At least one wall shall be open to the outside (e.g. through a steel mesh gate or louvered wall) with no ventilation into the building. The open side/s shall be designed and constructed to prevent ingress of water.
- (b) Where storage cabinets are used, they shall be located indoors.
- (c) Packages and IBCs shall be protected from contact with moisture and ingress of moisture.
- (d) Any electrical equipment installed in the storage area shall be—
 - (i) suitable for use in a hazardous area, as designated in the AS/NZS 60079.10 series, as follows:
 - (A) For PG I – Zone 1
 - (B) For PG II and III – Zone 2;
 - (ii) installed in accordance with the requirements of AS/NZS 3000; and
 - (iii) approved for use with any gas that may evolve from the goods being stored.

- (c) Firefighting equipment capable of extinguishing any fire in the store shall be installed. The firefighting medium shall be compatible with the dangerous goods of Division 4.3.

8.4.2 Separation distances

The storage area for packages of Division 4.3 dangerous goods shall be separated from protected places and boundaries by at least 5 m. This distance may be measured around a firewall having an FRL of at least 240/240/240.

8.5 DIVISION 4.3 PG I

8.5.1 General

The following additional requirements apply to the storage of dangerous goods of Division 4.3, PG I:

- (a) The store shall be located within a bunded compound complying with Clause 4.6 and having sufficient capacity and strength to—
 - (i) contain the goods in the event of fire – where the goods are liquids or will liquefy in a fire; and
 - (ii) prevent water entering the store at ground level.
- (b) Dangerous goods of other Classes, or combustible materials, shall not be kept in the same storage area as the Division 4.3 PG I dangerous goods.

8.5.2 Separation distances

Package stores and tanks containing dangerous goods of Division 4.3, PG I shall be separated from foodstuffs, protected places and boundaries by at least 15 m.

8.6 DIVISION 4.3 PG II

Dangerous goods of other classes, or combustible materials, shall not be kept in the same storage area as Division 4.3 PG II dangerous goods.

8.7 DIVISION 4.3, SUBRISK 3

Dangerous goods of Division 4.3 that have a Subsidiary Risk of Class 3 shall be stored in accordance with the more stringent of the requirements of AS 1940 or this standard, except that they shall be kept in a separate store from other Class 3 dangerous goods and shall be subject to the following conditions:

- (a) A risk assessment shall be conducted to identify the appropriate fire protection requirements for the store.
- (b) Fire protection equipment shall be based upon the Division 4.3 classification in addition to the Class 3 hazard.

SECTION 9 OPERATIONAL AND PERSONNEL SAFETY

9.1 SCOPE OF SECTION

This Section sets out requirements and recommendations on matters relating to operational and personnel safety. It applies to all stores greater than minor storage, but may provide guidance for operators of such storage.

Requirements and recommendations that are specific to the storage and handling of specific Class 4 dangerous goods are set out in the relevant sections of this Standard. Those specific requirements take precedence over the requirements in this Section.

9.2 GENERAL PRECAUTIONS

9.2.1 Control of entry

In order to prohibit unauthorized personnel from gaining access to the installation, a member of the occupier's staff should accompany those visitors, contractors' personnel and other persons whose duties require their entry into a restricted area. Where this cannot be done, such persons shall, before entry into such an area, be given a written list of the hazards present and the appropriate precautions to be observed.

It is recognized that compliance with this requirement is not possible where emergency services personnel have to enter unattended premises to attend to an emergency. A safety information board displaying relevant precautions is sufficient for such purposes.

Any restricted area shall be kept locked whenever it is unattended.

9.2.2 Clear access

The means of entry into and exit from the areas where Class 4 dangerous goods are kept or handled shall be kept clear at all times.

At all times, access shall be available to—

- (a) firefighting equipment;
- (b) personal protective equipment;
- (c) clean-up materials and equipment; and
- (d) the place where the manifest is kept.

9.2.3 Vehicular access

The following requirements apply:

- (a) Vehicular access to, and movement within, a restricted area shall be controlled.
- (b) Vehicles shall be confined to a designated safe area unless they are suitable for use in the hazardous zones.
- (c) Speed limits shall be imposed where appropriate, and shall be indicated by signs.
- (d) Vehicles shall be parked in designated parking places and comply with any operating and emergency procedures.

9.2.4 Lighting

The following requirements apply to lighting whenever people are working in an area where Class 4 dangerous goods are kept:

- (a) Lighting, of sufficient luminance as to enable a person to easily read all markings on containers, signs, instruments and other necessary items, shall be available in areas where people are working. Interior lighting shall be of at least the luminance specified in AS/NZS 1680.1.
- (b) Where there is a risk of flammable gas being emitted, lighting shall comply with the requirements of AS/NZS 60079.10.1.
- (c) (Australia) Where combustible dusts are present, the requirements of the relevant part of AS/NZS 61241 shall apply.
- (d) (New Zealand) Where there is a risk of flammable gas being emitted or combustible dusts being present, hazardous areas shall be delineated and the lighting shall be suitable for these hazardous areas.
- (e) Sufficient lighting shall be available on any of the installation's internal roads when personnel on the premises might use them.

9.2.5 Ventilation

Whenever people are in an area where Class 4 dangerous goods are kept, the following requirements shall apply:

- (a) The store shall be provided with adequate natural or mechanical ventilation.
NOTE: Adequate ventilation is dependent on the nature of the substance being kept and the circumstances of its use.
- (b) Ventilation shall be sufficient to maintain the ambient concentration of any vapours or dusts in the storage area as low as practicable. Where the substance has been assigned an exposure standard, exposure levels shall be kept below this level.
NOTE: Where no exposure standard is assigned to a substance, it is not implied that the substance is non-hazardous.
- (c) Where mechanical ventilation is required, the system shall comply with the requirements of AS 1668.2/NZS 4303. Exhaust air dilution by means of general exhaust ventilation and local exhaust ventilation are appropriate techniques. Exhaust air flow rates shall be determined by an appropriately qualified engineer.
NOTE: The extraction system may require a scrubber prior to venting the atmosphere.
- (d) No active or potential ignition source shall be introduced as part of a mechanical ventilation system.

9.2.6 Control of ignition sources

9.2.6.1 Introduction of ignition sources

A work permit shall be obtained before introducing any active or potential ignition source into the restricted area (see also Clause 3.10).

Conditions for work permits are provided in Clause 9.5.3.

9.2.6.2 Portable electrical equipment

Portable electrical devices shall not be taken into a hazardous area unless certified for use in such a zone or authorized by a work permit.

NOTE: This is to control ignition sources such as torches, rechargeable power tools, pagers, phones and cameras, but not low-energy devices such as hearing aids or completely enclosed objects such as battery-powered watches.

9.2.6.3 Smoking

Smoking and the carrying of matches or cigarette lighters shall be prohibited in any hazardous areas and within any restricted area.

9.2.6.4 Earthing and bonding

Static electricity shall be controlled in accordance with AS/NZS 1020. Lightning protection shall comply with the requirements of AS 1768. Earthing shall comply with AS/NZS 3000.

NOTE: Bonding and earthing are often confused with each other. Bonding connects all items in which static electricity could build up. For example, a tank, pump, filling nozzle and receiving container might be connected with each other through pipes with bridged flanges, conductive transfer hoses and bonding wires and clips.

Earthing discharges currents into the ground. It is not intended to provide the continuous circuit required for bonding and should not be used as a means to control static electricity.

9.2.6.5 (New Zealand) Control of ignition sources

In New Zealand, control of ignition sources comply with the Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001, regulation 78.

9.2.7 Site upkeep

The area in and around any store or compound shall be maintained in a safe condition. The following requirements apply:

- (a) The area within the store, and for a distance of 3 m from it, shall be kept clear of all extraneous materials.
- (b) Specified clearance distances shall be maintained at all times.
- (c) Packages shall not be placed where they could jeopardize entry and exit.
- (d) Vegetation that could become a fire hazard shall be kept short.
- (e) Any compound drain valve shall be kept closed and locked except during supervised drainage. A notice bearing the words BUND DRAIN VALVE—TO BE KEPT CLOSED AND LOCKED shall be displayed.
- (f) Spills shall be cleaned up as soon as possible.

9.2.8 Bunds and compounds

Bunds shall be maintained to retain their designated capacity and in a condition that will prevent the escape of any liquid from the compound.

All bunds and compounds shall be kept free from extraneous material, e.g. packagings, pallets, tree branches, leaves.

9.2.9 Doors and doorways

The following requirements apply:

- (a) Any self-closing door to a store or cabinet shall not be propped open.
- (b) Doorways shall be kept clear so as not to impede the closing of fire doors in an emergency.
- (c) The area to be kept clear around a fire door shall be clearly marked.

9.2.10 Bulk storage installations

The means of access to bulk storage compounds, including ladders, catwalks and platforms around tanks, shall be maintained in a safe condition.

Hatches, manholes, tank openings and the like shall be kept closed when not in use.

9.2.11 Package stores

Package stores are intended for the keeping of intact, closed packages of Class 4 dangerous goods. The following procedures in connection with storage of packaged Class 4 dangerous goods shall be established and maintained:

- (a) The aisles inside the store shall be kept clear (see also Clause 9.2.2).
- (b) Packages shall be regularly inspected and, when any signs of a spill, leak or deterioration of the package are observed, the suspect package shall be taken out of the store for examination, and repackaging if required. Such repackaging shall be performed in accordance with Clause 5.10.
- (c) Any contamination of the outer package shall be removed prior to replacing the package in the store.
- (d) Minor spills or seepage on the floor, walls or racks shall be treated in accordance with Clause 10.5.
- (e) Any packages that have been opened or partially used shall be clearly identified and used first.
- (f) Labels shall be retained on emptied containers until the containers have been decontaminated, at which time the labels shall be removed or obscured.
- (g) Unless they have been decontaminated, empty containers that have held Class 4 dangerous goods shall be treated as though containing Class 4 dangerous goods, except that it may not be necessary to keep them in a compound.

9.2.12 Safety information

Material safety data sheets (MSDS), describing the properties of the substances being kept and appropriate first aid measures for them, shall be readily accessible.

9.3 OPERATING PROCEDURES

9.3.1 General requirements

Safe systems of work, including procedures commensurate with the quantity and nature of the substances being kept, shall be developed, documented and implemented.

Written procedures shall include the following, as relevant to the installation:

- (a) A site plan (or plans) indicating tanks, plant, main pipework, switchboards or substations, emergency stop valves or actuating devices, fire protection systems and drainage.
- (b) Operating procedures covering all aspects of the day-to-day operation of the installation.
- (c) Maintenance procedures covering regular testing, inspection and monitoring of the equipment.
- (d) Emergency procedures covering actions to be taken in the event of fire, spillage, accident, equipment failure or other abnormalities or emergencies (see also Section 10).

Procedures shall be documented in notices, manuals or other recorded instructions as appropriate to the particular installation. They shall be either on view or readily available on site.

All personnel shall be trained in and comply with the procedures established for the installation. An audit system should be established to ensure compliance.

Procedures shall be reviewed regularly and modified as necessary, particularly following any equipment or organizational changes.

(New Zealand) Locations holding hazardous substances are required to obtain a Location Test Certificate from a test certifier if the quantities held are over the threshold listed in the Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001. Refer to Appendix D, Table D1, for location test certificate thresholds for Class 4 substances.

(New Zealand) Certain Class 4 substances are required to be under the control of an Approved Handler. An Approved Handler is a person who is competent and certified to handle certain hazardous substances. To become an Approved Handler you must meet the requirements of the *Hazardous Substances and New Organisms (Personnel Qualifications) Regulations 2001* and be approved by a test certifier. Refer to Appendix D, Table D3, for threshold quantities of Class 4 substances that activate this requirement.

9.3.2 Operating procedures

Operating procedures shall include, but not be limited to, the following as appropriate to the installation:

- (a) Initial commissioning.
- (b) Normal handling.
- (c) Product transfer.
- (d) Monitoring of essential functions and components
- (e) Control of hazards including ignition sources.
- (f) Manufacturers' operating instructions for equipment.
- (g) Earthing and bonding.
- (h) Fault conditions.
- (i) Housekeeping and site upkeep.
- (j) Isolation, deactivation and identification of equipment not in use.
- (k) Maintenance of clear spaces for access.
- (l) Personnel safety and protective equipment.
- (m) Environmental monitoring.
- (n) Operation of utilities.
- (o) Fire protection systems
- (p) Control of access, movement and activities

9.3.3 Construction and maintenance procedures

These procedures shall include the following as appropriate to the installation:

- (a) Work authorization, including the issuing of work permits.
- (b) Work in confined spaces.
- (c) Testing of instrumentation, protective devices, alarms and monitors.
- (d) Isolation and tagging of equipment.
- (e) Control of contractors.
- (f) Firefighting equipment.
- (g) Pipework.
- (h) Storage tanks.

- (i) Drainage systems and any separators.
- (j) Bunds.
- (k) Electrical equipment.
- (l) Ventilation systems.
- (m) Fences and security.
- (n) Lighting.
- (o) Signs and notices.
- (p) Plant components, including pumps, fans, package filling equipment.

9.3.4 Emergency procedures

Emergency procedures and first aid procedures shall be prepared in accordance with Section 10 and Clause 9.9.

9.3.5 Inspection of plant and equipment

In order to ensure that items of plant and equipment are in a serviceable condition, they shall be periodically inspected by a trained person, as follows:

- (a) Bulk containers, pipework, valves, pumps, gauges, alarms and other safety devices shall be inspected visually or by simulation of operating conditions or by non-destructive testing.
- (b) All vents shall be inspected to ensure that passages are clear and that any relief valves are in an operable condition.

The type and date of inspection, the results, and the name of the person who conducted it shall be recorded and retained.

In New Zealand, an annual stationary container systems test certificate may be required. Refer to Schedule 8 of *Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004* (as amended) for stationary container certification requirements. A test certifier must be contacted for the issuing of the test certificate.

9.3.6 Commissioning of new, modified or repaired equipment

No equipment or installation shall be put into services unless a hazard identification and risk assessment has been undertaken to ensure that appropriate controls are in place. In addition, appropriate operating and emergency procedures shall be available and personnel shall have been trained in the operation of the equipment, recognition of fault conditions and actions to be taken if fault conditions occur.

9.4 EFFLUENT CONTROL

Effluent control shall be provided in accordance with regulatory requirements.

Effluent lines shall be monitored to ensure—

- (a) compliance with any regulatory requirements relating to the discharge of harmful effluent; and
- (b) that any harmful effluent does not escape from the premises before it has been appropriately treated.

Accurate, up-to-date records shall be maintained for all such monitoring.

9.5 CONSTRUCTION AND MAINTENANCE WORK

9.5.1 General

Construction or maintenance work shall not be carried out in any store or cabinet in which Class 4 dangerous goods are kept, except with written authorization from a person designated for the purpose by the occupier of the premises.

When contemplating such work, the effect of carrying it out shall be evaluated. Where there is any doubt about the safety of the intended procedures, the Class 4 dangerous goods shall be moved to another location before the work is commenced.

When maintenance work is to be carried out in a workshop on equipment from an area where Class 4 dangerous goods are kept, such equipment shall be checked to ensure that no residues remain, prior to the maintenance work being carried out.

NOTE: Particular care needs to be taken where hollow sections might contain residues.

9.5.2 Routine work

Any routine, non-hazardous work shall be supervised in such a manner as will ensure its safe conduct.

9.5.3 Work permit

Except for routine, non-hazardous work, any work within a restricted area shall be authorized by means of a work permit. The work permit shall be issued only by a person designated for the purpose by the occupier of the premises.

A work permit shall include statements of the following:

- (a) The nature and extent of the work.
- (b) Any conditions to be observed.
- (c) Any special conditions relating to hot work.
- (d) Any personal protective clothing or equipment to be used.
- (e) The period for which the permit is valid.
- (f) Any regular checking necessary to ensure that the safety requirements and conditions remain in force, e.g. atmospheric monitoring.
- (g) Any necessary procedures and precautions for returning the plant to normal service.
- (h) Any firefighting equipment required to be at hand.
- (i) Authorization.

A work permit may define, within the restricted area, a safe area in which major maintenance or construction work may be performed without further permission. Such an area shall be determined in relation to any storages and plant, so that unrestricted use of ignition sources does not create a hazard. The physical limits of such an area shall be clearly marked.

Considerable care is still required in the safe area, as some articles (e.g. used tanks, pipes and containers) might contain residues or might be hazardous in themselves, regardless of their location. The danger of ignition of any pyrophoric materials when exposed to air shall also be taken into account.

9.5.4 Preparation of work site

The relevant work site and plant shall be prepared in a manner that prevents the risk of fire, explosion or exposure of personnel to a hazardous substance.

Precautionary measures shall include the following, as appropriate:

- (a) Identification of both the equipment to be worked on and all other affected equipment.
- (b) Depressurization and disconnection of equipment.
- (c) Isolation and locking-off of the equipment from other equipment.
- (d) Purging of the equipment.
- (e) Removal of any hazardous substances.
- (f) Sealing-off of sewers, drains and gutters.
- (g) Provision of fire protection equipment.
- (h) Testing of the work environment for flammable vapours and oxygen content.

9.5.5 Completion of work

After completion of any work that is covered by a work permit, and before the plant is to be returned to service, a check shall be made to ensure that—

- (a) the work has in fact been completed;
- (b) any temporary arrangements (e.g. bypass lines or blank flanges) have been removed;
- (c) all personnel and equipment are accounted for;
- (d) the work permit has been cancelled or signed off and the plant is cleared for return to service; and
- (e) all related equipment and facilities, including bunds, scrubbing systems (where relevant) and fire systems are operational and have been inspected and tested appropriately.

This check shall be done by the person who issued the work permit.

9.5.6 Hot work

Any work involving cutting or welding by gas or electric arc or any work of equivalent risk (e.g. grinding, drilling, or the use of percussion tools) shall not be undertaken within a restricted area unless—

- (a) a work permit has first been obtained; and
- (b) any flammable or hazardous residues or vapours have been removed.

The requirements of AS 1674.1/NZS 4781 shall be observed in relation to any hot work undertaken.

NOTE: Particular care needs to be taken where hollow sections may contain solid residues.

9.5.7 Work inside a confined space

Wherever it is intended to enter or work in a confined space, a confined space entry permit shall be issued and the requirements of AS/NZS 2865 shall apply.

9.6 PERSONNEL TRAINING

9.6.1 Job knowledge

All personnel handling Class 4 dangerous goods on the premises shall be made fully conversant with—

- (a) the means of identifying dangerous goods and the properties of the specific substances handled, by reference to the relevant MSDS or equivalent source of information; and
- (b) applicable safety requirements and safe-handling procedures.

9.6.2 Training

Personnel employed on the premises shall be trained as appropriate in—

- (a) the nature of the work and safe methods of operation;
- (b) the properties of, and hazards associated with, the substances being handled;
- (c) the correct use of personal protective equipment;
- (d) the location of first aid equipment, and first aid measures to be taken;
- (e) the correct use of personal protective equipment, and its care and maintenance;
- (f) actions to be taken in various emergencies, including spills, vapour escape, fire and explosion;
- (g) control measures in place at the facility; and
- (h) the content and operation of the safety management system.
- (i) (New Zealand) Personnel handling certain class 4 substances are required to be certified as an Approved Handler in accordance with the *Hazardous Substances and New Organisms (Personnel Qualifications) Regulations 2001*. Refer to the Appendix D, Table D3, for Class 4 threshold quantities activating this requirement.

Simulated emergency exercises and appropriate fire equipment use and emergency response shall comprise part of the training.

9.6.3 Contractors

Contractors and their staff shall be trained in the following, as appropriate to the specific task to be performed:

- (a) Safety rules of the installation, including any restrictions on movement, access, activities and the use of personal protective equipment.
- (b) Conditions and obligations associated with work permits and confined space entry permits.
- (c) Hazards likely to be encountered, including any materials stored or handled on site.
- (d) Procedures to be followed in the event of an incident, e.g. spillage, accident or fire.

9.6.4 Personal hygiene

The requirements for all persons whose work involves the handling of Class 4 dangerous good shall be as follows:

- (a) Do not introduce, keep, prepare or consume any food or drink, apply cosmetics or use tobacco, in any place where Class 4 substances are stored or handled.
- (b) After handling the substances, always wash your hands before eating, drinking, applying cosmetics, smoking or using the toilet, and after work.
- (c) Immediately attend to injuries caused by contact, or suspected contact, with the substances.

The above directions, or wording to the same effect, shall be prominently displayed in the work area.

NOTE: Occupational health and safety regulations also apply.

9.7 RECORDS

Records shall be kept of the following:

- (a) Training and re-training (permanent record).
- (b) Equipment tests required by this Standard and other Standards.

- (c) In-service inspections (life of installation).
- (d) Emergency drills (six years).
- (e) Maintenance and repairs (life of installation).
- (f) Incidents including fires, significant spillage, accident, injury, or dangerous occurrence (life of installation).
- (g) Safety and security management plans (current)
- (h) Safety Data Sheets (current)
- (i) Inventory records of substances kept or stored on the premises (current).

NOTES:

- 1 The suggested retention periods are given in parentheses.
- 2 Regulations may require differing periods for the retention of such records.

9.8 PERSONAL PROTECTIVE EQUIPMENT

9.8.1 General

Where Class 4 dangerous goods are stored or handled—

- (a) all persons on the premises shall be provided with appropriate personal protective equipment and trained in its correct use;
- (b) personal protective equipment shall be kept in designated, well-identified locations away from sources of contamination, and ready for use; and
- (c) all personal protective equipment shall be maintained in good and functional condition.

9.8.2 Types of personal protective equipment

The following personal protective equipment shall be provided, as appropriate to the operational requirements of the site:

- (a) Protective clothing suitable for use with the specific Class 4 substances.

NOTE: The appropriate MSDS should be consulted. Periodic inspection should be carried out to ensure the continuing serviceability of such clothing.

- (b) Eye protection, selected in accordance with AS/NZS 1337.
- (c) Protective gloves complying with the relevant parts of the AS/NZS 2161 series.
- (d) Safety helmets complying with AS/NZS 1801 and selected in accordance with AS/NZS 1800.
- (e) Safety footwear complying with AS/NZS 2210.2 and selected and maintained in accordance with AS/NZS 2210.1.
- (f) Respirators having appropriate filters, and self-contained breathing apparatus (SCBA) complying with AS/NZS 1716 and selected, used and maintained in accordance with AS/NZS 1715.

9.8.3 Care and maintenance of personal protective equipment

Personal protective equipment shall be kept separate from normal clothing. As a minimum, gloves should be worn when handling contaminated personal protective equipment and clothing after use. Precautions should be extended depending on the degree of contamination and the substance involved.

Protective clothing should not be taken home for laundering.

Personal protective equipment and clothing shall be maintained as follows:

- (a) After use, all personal protective clothing and equipment shall be cleaned in accordance with the manufacturer's instructions.
- (b) Gloves and boots shall be checked for leaks.
- (c) Self-contained breathing apparatus shall be maintained in accordance with AS/NZS 1715.
- (d) Grossly contaminated safety equipment or clothing shall be rendered unusable and disposed of in a manner approved by the local waste disposal authority.

NOTE: Occupational health and safety regulations also apply.

9.9 FIRST AID

First aid facilities and response will be dependent on the nature of the substance, its quantity, and the location of the industry.

An administrative procedure shall be in place to regularly review first aid advice as opinions on what constitutes an appropriate response may change.

The following requirements shall also apply:

- (a) A first aid station shall be provided in a clean area and shall be in the care of a responsible person. It shall comprise, as a minimum, an appropriate first aid kit and first aid instructions, e.g. copies of MSDSs, for all Class 4 dangerous goods being kept or handled on the premises.
- (b) A list of persons trained in, and designated as being responsible for the administering of, first aid shall be shown on all notice boards on the premises and at each first aid station. The names and telephone numbers of one or more on-call physicians, the nearest hospital, the Poisons Information Centre and the ambulance service shall be included on the list.
- (c) In New Zealand, the telephone number of the National Poisons and Hazardous Chemicals Information Centre shall be included.
- (d) Eyewash facilities complying with AS 4775 shall be provided.

Where water-reactive substances are stored or used, the hazards associated with water shall be taken into account when choosing locations for eyewash facilities.

NOTE: Occupational health and safety regulations also apply.

SECTION 10 EMERGENCY MANAGEMENT

10.1 SCOPE OF SECTION

This Section sets out requirements and recommendations on planning for emergencies, maintenance of manifests, placarding/signage and management of spills and leaks.

10.2 PLANNING FOR EMERGENCIES

10.2.1 Considerations in designing premises

The likelihood of an incident occurring in an area used for the storage and handling of dangerous goods (including those of Class 4) can be minimized by good design and layout, sound engineering, good operating practices, and proper training of personnel in the performance of their duties.

Specific provision for emergencies in the design and layout is addressed in Clause 4.2.3.

10.2.2 Emergency plan

A detailed plan shall be prepared for managing emergencies that could occur on site. Potential hazmat emergencies should be identified from the dangerous goods risk assessment and draw on site historical data and relevant industry incident data. The plan should be prepared in consultation with workers at the site.

The plan should be prepared in consultation with the emergency services and relevant regulatory authorities.

The emergency plan shall—

- (a) take into account any potential for the occurrence of fire, explosion, natural disaster, reaction or release of the dangerous goods;
- (b) include the likely consequences of such an occurrence to workers, the community, emergency workers and the environment, both onsite and offsite, including synergistic and 'knock on' effects;
- (c) be appropriate to the size and complexity of the installation, its resources and personnel; and
- (d) be regularly reviewed and updated as necessary (see Clause 10.2.3).

Plant personnel shall be familiar with the contents of the emergency plan.

NOTES:

- 1 Information to be included and recommended documents containing guidelines on the preparation of emergency plans, are listed in Appendix C.
- 2 Some jurisdictions may have related regulatory requirements, e.g. a fire evacuation plan. An evacuation plan should not be confused with the hazmat emergency plan.
- 3 In New Zealand, the legal requirements for an emergency response plan are set out in *Hazardous Substances (Emergency Management) Regulations 2001*, or HSNOCOP 36.

10.2.3 Review of emergency plan

The emergency plan shall be kept up-to-date and reviewed and revised where necessary. For example, a review should be undertaken whenever—

- (a) a new type of dangerous goods is introduced to the premises;
- (b) the quantity of dangerous goods being kept is changed;
- (c) a change is made to the way the dangerous goods are stored or handled;
- (d) a change is made in a process or procedure, which might result in a change of risk;

- (e) a new information regarding the hazardous properties of a material is established; or
- (f) deficiencies are identified during training or after an incident.

10.3 MANIFEST

A manifest shall be provided and maintained in accordance with regulatory requirements.

The manifest shall consist of three main components:

- (a) Emergency contact information.
- (b) An inventory of hazardous materials at the premises.
- (c) A site plan.

NOTE: Guidance in developing the manifest is provided in Appendix C.

A copy of the manifest shall be kept in a location near the main entrance in accordance with regulatory requirements or otherwise determined in consultation with the emergency services authority.

10.4 PLACARDING AND OTHER SIGNAGE

10.4.1 Placarding

Every installation in which dangerous goods are kept in quantities exceeding regulatory thresholds shall be placarded in accordance with Australian or New Zealand regulatory requirements.

NOTE: Regulatory requirements for placards may require an outer warning placard for the site and information placards for individual storage areas or tanks within the site.

10.4.2 Other signage

The following additional signs shall be displayed, as appropriate:

- (a) A warning sign to prohibit smoking and to exclude other ignition sources, e.g.—
DANGER: NO SMOKING, NO IGNITION SOURCES.
- (b) A warning sign to restrict entry, e.g.—
WARNING: RESTRICTED AREA, AUTHORIZED PERSONNEL ONLY.
- (c) A sign listing emergency contact names, titles and phone numbers relevant to the installation.
- (d) The name, address and phone number of the occupier.
- (e) A layout diagram showing the location of any fixed fire protection facilities (where installed), the drainage system and any emergency stop switches.
- (f) Any other notices or warnings that may be required by the relevant regulatory authorities, which may include action to be taken in the event of a spill, fire or leak.

These additional signs shall have lettering that contrasts with the background and is clearly legible from any access point. Unless otherwise required, signs shall comply with:

- (i) (Australia) AS 1216 and AS 1319.
- (ii) (New Zealand) The HSNO Act or a code of practice approved under that Act such as HSNO COP 2 'Signage for Premises Storing Hazardous Substances and Dangerous Goods'.

Composite signs or graphic symbols complying with these requirements may be used.

All signs shall be maintained to be legible.

10.5 MANAGEMENT OF LEAKS AND SPILLS

10.5.1 General

Every endeavour shall be made to prevent leaks or spills, and to contain and control them if they do occur. Clean-up action shall be initiated immediately. Leaked or spilled dangerous goods (including Class 4) shall be kept and disposed of in accordance with Section 12. The decontamination and clean-up procedure and subsequent investigation shall be carried out by properly equipped and trained personnel.

NOTE: Entry into the affected area during response and clean-up operations should be limited to personnel directly involved. Such personnel should always be under the supervision of a responsible person.

10.5.2 Clean-up materials and equipment

The following items of clean-up materials and equipment shall be readily available on premises where Class 4 dangerous goods are kept or handled, as appropriate to the nature of those goods:

- (a) An adequate supply of water (not required for dangerous goods of Division 4.3).
- (b) Suitable non-combustible, inert absorbents, e.g. clean sand, where liquids are kept or handled.
- (c) Equipment for sweeping up leaks and spills of solids, and for sweeping up absorbent that has been used to absorb liquids. A broom or brush is suitable.
- (d) Clean, sealable (and where appropriate, vented) waste bins made of plastics or other appropriate material compatible with the dangerous goods being dealt with, for containing absorbed spills.

NOTE: These bins should not be filled to more than two-thirds of their capacity.

- (e) Appropriate personal protective equipment.

10.6 MANAGEMENT OF LEAKS AND SPILLS

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- (d) Clean, sealable (and where appropriate, vented) waste bins made of plastics or other appropriate material compatible with the dangerous goods being dealt with, for containing absorbed spills.

NOTE: These bins should not be filled to more than two-thirds of their capacity.

- (e) Appropriate personal protective equipment.

10.6.3 Actions for dealing with leaks and spills

At every occurrence of a leak or spill, the emergency plan shall be implemented and consideration given to notifying the emergency services.

Leaking packages shall be positioned in such a manner as to stop or minimize the leak and, if necessary, shall be moved to a safe location. Either the package should be placed in a suitable container, e.g. plastic bag or an oversize drum, or its contents should be transferred to clean packaging. The exterior of such clean packaging shall be clearly labelled in accordance with Clause 1.6.

NOTE: Any new package may need to be vented.

Small spills on the floor, or on the walls or structures of a building, should be absorbed, and the absorbent placed in a suitable waste container for disposal.

Emergency services should be notified whenever—

- (a) the dangerous goods have spread, or have the potential to spread, beyond the boundary of the installation;
- (b) it is beyond the resources of the occupier to deal with the incident effectively;
- (c) the protective equipment available is inadequate for dealing with the situation;
- (d) personnel are not experienced in dealing with the situation; or
- (e) personnel and the public are, or could potentially be, placed at risk.

10.6.4 Maintenance of clean-up equipment

After use, all clean-up equipment shall be decontaminated and dried. It shall be inspected for damage and returned to its designated storage area.

A check should be made to ensure that all emergency equipment has been returned clean and in good working order.

SECTION 11 FIRE PROTECTION

11.1 SCOPE OF SECTION

This Section sets out requirements, recommendations and considerations relating to protection of stores of Class 4 dangerous goods from fire and for the fighting of fires in such stores.

NOTE: It is essential that the requirements of the relevant regulatory authorities, including the fire authority, be observed. Such requirements take precedence over any requirements of this Section.

11.2 GENERAL CONSIDERATIONS

Class 4 dangerous goods can present the following specific hazards during a fire:

- (a) They might give off flammable fumes and smoke, which may increase the intensity of the fire.
- (b) A risk of explosion from flammable gas or dust generated.
- (c) Combustion products can be present at a distance from the main site of the fire, and have no odour.
- (d) The following products can result from chemical fires: carbon dioxide, carbon monoxide, hydrochloric acid fumes, hydrogen cyanide, sulphur dioxide, and oxides of nitrogen (particularly from smouldering fires). Other combustion products specific to the dangerous goods will also be present.
- (e) Spilled substances and contaminated debris might be toxic.
- (f) Some substances react violently with water or other chemicals, causing them to be sprayed over a wide area, or forming a flammable gas or another substance that is hazardous in its own right.
- (g) Run-off from fires might present a hazard to persons and the environment.
- (h) Sealed packages containing volatile materials could rupture on heating.

11.3 FIRE PROTECTION REQUIREMENTS

11.3.1 General

Fire protection is an important consideration in storage and handling locations for dangerous goods. Fire protection requirements for the premises shall be obtained from, and be implemented in conjunction with, the relevant regulatory authorities, including the fire authority. As a minimum, the fire protection provided for the store shall be in accordance with the BCA/NZBC.

For quantities of Class 4 dangerous goods greater than minor storage, the relevant fire authority should be consulted in regard to the proposed fire protection.

Fire protection systems shall be appropriate for the hazard and include consideration of adjoining activities and materials, to not only deal with incidents in the dangerous goods but also minimize the potential for the dangerous goods to become involved through the escalation of another incident.

The following requirements and recommendations apply:

- (a) Where the dangerous goods being stored are of Division 4.1 or 4.2 and have a Class 3 Subsidiary Risk, the fire protection requirements of AS 1940 shall apply.

The above requirement does not apply to dangerous goods of Division 4.3.

- (b) (New Zealand) Where hazardous substances of Class 4 are being stored, fire protection must comply with Hazardous Substances (Emergency Management) Regulations 2001. Appendix D, Table D4, specifies the threshold quantities of Class 4s requiring fire extinguishers, and also specifies the number of fire extinguishers required.
- (c) All firefighting equipment and fire-protection systems shall be designed, installed, operated, tested and maintained in accordance with the relevant Australian or New Zealand legislation.
- (d) All firefighting equipment shall be kept readily accessible at all times.
NOTE: In New Zealand, fire extinguishers must of at least a 30B rating, and be within 30 m of the substance; or, be in/on the vehicle transporting the substance.
- (e) All firefighting connectors and booster connections shall be compatible with those of the local fire authority.
- (f) Where portable fire extinguishers of suitable type and capacity are required in a store or handling area for Class 4 dangerous goods, they shall be installed in accordance with AS 2444/NZS 4503.
NOTE: A greater number may be specified in another relevant Australian Standard or by the relevant regulatory authority.
- (g) All firefighting media provided in storage and handling areas for Class 4 dangerous goods shall be compatible with the specific Class 4 dangerous goods being kept. This is particularly important when storing Division 4.3 dangerous goods, which are highly reactive with water; and for finely divided Class 4 substances where the use of pressurized extinguishing agent could lead to dust explosions.

A number of Class 4 dangerous goods require specialized firefighting agents and equipment that may be outside the normal inventory of the local fire service. Liaison should be maintained with the fire service to ensure that appropriate response can be undertaken for any fires involving the Class 4 dangerous goods on site. This may require stocks of firefighting media and equipment to be provided on site for use by the attending fire service.

11.3.2 Equipment compatibility

In designing the fire protection system, equipment needs to be optimized and adaptable so that it can be used effectively in a variety of likely events.

Materials used in the fire protection system shall be suitable for the conditions of use and compatible with the substances being stored. All firefighting media, appliances, equipment, components, hoses, connectors, booster connections and the like shall be compatible with those of the local fire authority at all essential interfaces.

11.3.3 Location of firefighting equipment

Firefighting equipment shall be located so that it is reasonably adjacent to the risk being protected and accessible without undue danger in an emergency.

(New Zealand) Fire extinguishers shall be located at most 30 m from the substance, or be in/on the vehicle transporting the substance.

11.3.4 System integration

Fire protection facilities specified in this Standard shall be either—

- (a) an independent system; or
- (b) integrated with other fire protection systems covering this or adjoining installations, to achieve the same result (mutual aid).

This integration shall be dependent on the nature of the dangerous goods being kept and the type of fire protection required. Integration requirements should be in line with the Safety Integrity Level (SIL) determined under AS/NZS 61508.

11.3.5 Weather protection

Firefighting equipment that is susceptible to corrosion or degradation by weather, the environment, ultraviolet light, fumes and the like, shall be protected by a sheltered location or a protective enclosure, with the contents suitably labelled.

11.3.6 Labelling of firefighting equipment

All firefighting equipment shall be marked or labelled in accordance with the relevant Australian Standard/Hazardous Substances (Compressed Gases) Regulations. Other firefighting resources such as water storage tanks shall be clearly identified.

11.3.7 System drawings

A layout plan showing the locations of all tanks, shut-off valves, pipelines, hydrants and firefighting systems shall be made and kept available for ready reference.

Wall charts showing this plan should be displayed in strategic locations.

11.3.8 Impact protection

All equipment, piping and valves shall be adequately supported and protected, taking into account the potential for traffic damage and projectile impact in a fire.

11.3.9 Maintenance

Fire protection systems and equipment shall be maintained in accordance with AS 1851.

11.4 METALLIC POWDERS

Metallic powders constitute a special risk because they are capable of burning fiercely and reacting violently with water.

Among the substances suitable for use on the majority of metal powder fires are powdered graphite, talc, soda ash, limestone and sand, all of which need to be in a dry state. The extinguishing agent should be carefully spread on the fire, starting from outside the burning area and working towards the centre, using long-handled scoops or shovels. The utmost care is necessary to avoid any disturbance of the burning powder until it has cooled below its ignition temperature.

Suitable chemical dry powders may also be used in bulk form, as above, or from portable extinguishers having low velocity, long-reach discharge applicators, subject to the dry chemical being non-hygroscopic and having low toxicity.

Water or other extinguishers shall not be used. A notice to this effect, together with the 'USE NO WATER' supplementary fire symbol is to be conspicuously displayed at each storage area.

11.5 CALCIUM CARBIDE

Calcium carbide reacts violently on contact with moisture or water, producing acetylene gas, which can become a fire and explosion hazard.

Water or other extinguishers shall not be used. A notice to this effect, together with the 'USE NO WATER' supplementary fire symbol is to be conspicuously displayed at each storage area.

Suitable chemical dry powder or dry sand may be used on calcium carbide fires, but no other agents should be used. In a fire, drums of calcium carbide may be cooled by spraying with water but contact of the substance with water shall be avoided.

11.6 ACTION IN THE EVENT OF FIRE

The action to be taken in the event of fire is as set out in the emergency plan (see Clause 10.2.2). In the event of fire, the emergency plan shall be implemented and the emergency services shall be notified. The management of a fire shall be the responsibility of the fire authority.

Actions to be taken at the premises in the event of a fire shall be in accordance with the emergency plan. Such actions should include the following as relevant:

- (a) Call the fire brigade—Dial 000 in Australia, 111 in New Zealand.
- (b) Evacuate the premises.
- (c) Close down plant and equipment.
- (d) Keep unauthorized personnel away.
- (e) If significant smoke is generated, evacuate all people on the installation to a safe location upwind of the source.

The following action should only be undertaken by trained personnel:

- (i) Fight fire with the appropriate extinguishing medium. If only water is available, use as spray or fog. Do not use water jets—they break bags, glass containers and fragile packages.
- (ii) Take particular care with fires involving dangerous goods of Divisions 4.2 or 4.3, as they are highly reactive with water. The major goal in a fire of this type is not necessarily to extinguish the fire, but to eliminate the fuel. Extinguishing the fire may prove more hazardous, as more product may leak and again ignite in air, causing a larger fire.
- (iii) Ensure that fire-water and spilt product is contained within the premises as far as practicable. Protect public and semi-public water supplies.
- (iv) If run-off occurs, or dangers arise from exploding containers, consider withdrawing and allowing the fire to burn out.
- (v) If in an extreme emergency firefighting with water is essential for large-scale safety reasons and run-off cannot be controlled, inform the water and health authorities.
- (vi) Any person exposed to fumes, smoke or splashing, or any person showing signs of illness, dizziness or unusual behaviour should be placed under medical care. Poisoning can be mistaken for heat exhaustion, smoke inhalation or drunkenness. Remove contaminated clothing immediately.
- (vii) On completion of activities clean all equipment and clothing (see Clause 10.5.2).
- (viii) Where possible, and consistent with the protection of persons and property, the fire site should be preserved in order to assist investigators in determining the cause of the fire.

SECTION 12 WASTE STORAGE AND DISPOSAL

12.1 SCOPE OF SECTION

This Section sets out requirements and recommendations for the safe storage and disposal of wastes, minor spills and damaged containers.

12.2 STORAGE OF WASTES

Any installation in which Class 4 dangerous goods are kept or handled shall be provided with facilities for the storage of wastes and items contaminated with Class 4 dangerous goods. Such facilities shall comply with all of the requirements of this Standard.

Wastes that still meet the criteria of the ADG Code/HSNO Act for classification as Class 4 substances shall, pending their disposal, be kept in accordance with all of the relevant requirements of this Standard. Waste packages shall be clearly marked as such.

12.3 ITEMS FOR DISPOSAL

12.3.1 Class 4 dangerous goods

The following categories of Class 4 dangerous goods shall be disposed of in accordance with Clause 12.5:

- (a) Any contaminated substance, including that which is fire affected.
- (b) All substances collected as leaks or spills (see Clause 10.6.3).
- (c) All residues.
- (d) Substances of doubtful quality or having illegible container labels.

12.3.2 Other items

Other items that shall be disposed of in accordance with Clause 12.5 are as follows:

- (a) Empty containers for Class 4 dangerous goods, other than those to be re-used. (Such containers require pre-disposal treatment; see Clause 12.4.)
- (b) Washings or chemical treatment products related to the cleaning of empty containers.
- (c) Equipment or clothing heavily contaminated with Class 4 dangerous goods.
- (d) The contents of the store sump or compound used for collection of spills or run off.
- (e) Water used for showering and washing.
- (f) Contaminated soil.

12.4 PRE-DISPOSAL TREATMENT OF EMPTY CONTAINERS

12.4.1 General

Except where Division 4.3 dangerous goods have been stored, prior to their disposal, empty containers for Class 4 dangerous goods shall be decontaminated by—

- (a) triple rinsing with the appropriate solvent, the washings preferably being added to the material for use, or being set aside for disposal; or
- (b) chemical neutralization.

Except where the containers are to be refilled with the same substance, the container labels shall be removed or fully obliterated. Containers not for re-use shall be drained, punctured and preferably crushed to render them impossible to re-use.

12.4.2 Disposal treatment for Division 4.3 dangerous goods

Where permitted by the local environmental authority, empty containers should be decontaminated by allowing the residual dust to react with the water vapour in the surrounding air, and allowing the resultant gas to disperse by ventilation. The containers shall then be rendered unusable as described in Clause 12.4.1.

MSDS and technical data from the supplier or manufacturer of the dangerous goods should be consulted for advice on decontamination of empty containers, or the supplier contacted if this information is not available.

NOTE: Specialist waste disposal contractors may be able to accept or decontaminate the containers.

12.5 METHODS OF DISPOSAL

All hazardous substances must be disposed of by treating it using a method that changes the characteristics or composition of the substance so that it is no longer hazardous; or by exporting it from the country as a waste.

SDS and technical data from the supplier or manufacturer of the dangerous goods should be consulted for advice on decontamination of empty containers, or the supplier contacted if this information is not available.

The local waste management authority, the environment protection authority and the health department, as appropriate, should be consulted on the acceptability of the proposed method of disposal. Advice may also be provided by the suppliers of the Class 4 dangerous goods.

APPENDIX A
CLASS 4 DANGEROUS GOODS AND THEIR HAZARDS
(Informative)

A1 GENERAL

Class 4 dangerous goods all present a fire hazard in different ways. The Class includes a very wide diversity of chemical materials. Members of the class may be solid (including finely divided solids) or liquid (including molten solids). They may be categorized chemically as organic, inorganic or organometallic or may be biological. A number of metals belong to the class, especially when in finely divided form. Some Class 4 dangerous goods have subsidiary risks. Some are self-heating and may require temperature control. Many are used in small quantities in laboratories, while others are utilized at industrial scales. Some are highly specialized and unusual chemicals, while others are common products of agriculture. Brief overviews of a number of specific Class 4 dangerous goods are given below.

A2 FIRE HAZARDS

The primary risk arising from the storage and handling of Class 4 dangerous goods is that of fire and explosion, due to the flammable nature of these dangerous goods or of their products of decomposition. In this respect they are somewhat similar to Class 3 substances, except for their lack of mobility in comparison with the latter.

There is also a risk of explosion when Division 4.3 dangerous goods are involved and circumstances permit the accumulation of flammable gases that are generated in contact with water or water vapour.

Finely divided Class 4 materials may give rise to dust explosions when dispersed in air. This can occur when burning material is stirred up or disturbed as a result of a fire.

A3 OTHER HAZARDS

There are other hazards related to the storage and handling of Class 4 dangerous goods that are indicated by the allocation of a subsidiary risk in addition to the primary division.

Included among these additional hazards are toxicity, corrosive and oxidizing hazards and, in some cases, an inherent explosion hazard.

Class 4 dangerous goods of one division may also have a sub-risk of another division within Class 4.

Special care and attention needs to be paid to the compatibility of Class 4 dangerous goods with other goods when considering storage, and to the nature of protective equipment and fire protection when storing or handling these substances.

A4 SPECIFIC SUBSTANCES

A4.1 Aluminium and compounds

A4.1.1 *Aluminium metal and alloys*

Aluminium metal, in finely divided form, can burn and cause a dust explosion. It may also explode when mixed with acids, halogenated solvents or oxidizing agents. Aluminium dust can be produced by activities such as milling and pulverizing. The finer the particle size, the greater the hazard.

While bulk aluminium metal is not combustible, activities such as machining, milling and pulverizing can create aluminium dust.

In contact with water (including atmospheric moisture), aluminium dust may heat spontaneously and can release flammable hydrogen gas. If the aluminium is molten, an explosion can result.

Bulk aluminium metal, in contact with acids or alkalis, will also release hydrogen gas.

Magnesium-aluminium alloys present the same hazards but can be more reactive.

A4.1.2 Aluminium compounds

Aluminium compounds which are Class 4 dangerous goods include hydrides, carbides, phosphides, nitrides and others.

These compounds can react with water (including atmospheric moisture) to release flammable gases such as hydrogen (from hydrides), methane (carbides) and phosphine (phosphides). Nitrides release ammonia.

With some compounds such as lithium aluminium hydride and aluminium alkyls, the reaction with water can be violent.

A4.1.3 Aluminium phosphide

Aluminium phosphide is widely used as a fumigant for grain and other materials. It reacts with water (including atmospheric moisture) to release phosphine (a flammable and toxic gas). The industrial form can contain impurities which make the phosphine spontaneously combustible.

A4.1.4 Aluminium dross

Aluminium dross is a by-product of the smelting of aluminium. It is the residue from the lining of the electrolytic pots. It contains particles of aluminium metal and of aluminium compounds such as nitrides and carbides, and so presents similar hazards to those materials.

A4.2 Alkali metals and alkaline earth metals

Most alkali and alkaline earth metals (lithium, sodium, potassium, rubidium, caesium, calcium, strontium and barium but excluding magnesium) react rapidly with water or water vapour to generate flammable hydrogen gas and the metal hydroxide, which may be corrosive. The reaction produces heat, which in some cases is sufficient to ignite the generated hydrogen. In some cases the heat is sufficient to melt the metal as well.

These metals are generally stored under hydrocarbon liquids or inert gas in sealed containers to minimize reaction with water. Flammable or combustible hydrocarbons are often used for this purpose and fire fighting requirements need to be considered in this regard. The metals may range in form from solid lumps to fine filings or powder. Some are used in the molten state in specialized applications.

The actual metals will burn to produce corrosive oxides. Some produce peroxides on the metal surface over time on reaction with air. This which can lead to subsequent explosions when the metal is cut.

Magnesium varies in reactivity with particle size and shape. In larger bulk forms it may not be classified as a dangerous good, while thinner sheet, foil and ribbon may be a flammable solid. Swarf, turnings, filings, powders and dusts may be a flammable solid and/or dangerous when wet. Finer material may react with water to produce hydrogen gas, albeit generally more slowly than other alkaline earth metals. Fires involving magnesium are generally very hot and bright and firefighters may require specialized personal protective equipment to fight them. Finely divided magnesium may present a dust explosion hazard similar to other metallic powders.

Specialized firefighting techniques, equipment and fire extinguishing agents may be required.

A4.3 Calcium carbide

Calcium carbide is used in the production of acetylene gas which is highly flammable and potentially explosive. It reacts violently on contact with moisture or water, producing acetylene gas, which can become a fire and explosion hazard. Contaminated calcium carbide may release the toxic gas phosphine on contact with water.

Shock-sensitive compounds are formed with silver and copper salts.

A4.4 Desensitized explosives

A desensitized explosive is an explosive substance that has had its explosive properties suppressed by—

- (a) wetting the substance with water or alcohol;
- (b) diluting the substance by mixing with another non-explosive substance;
- (c) dissolving the substance in water, alcohol or other liquid; and/or
- (d) packaging the substance in such a way to be excluded from Class 1 by virtue of test results.

In their unwetted or undiluted form, they are substances that would meet the criteria for Class 1.

Explosive substances can be desensitized to different extents. For example, an explosive substance that is too sensitive to transport can be desensitized to a degree that enables it to be transported; but in this desensitized state, it still meets the criteria for a substance with explosive properties. Such substances should still be classified as explosive substances.

When substances are diluted so as to be exempt from the explosives classification by virtue of UN Tests, but they have flammable properties, then they are classified as Division 4.1, solid desensitized explosives.

Packagings for desensitized or phlegmatized substances must be closed to prevent changes in concentration during transport and storage.

‘Phlegmatized’ is a term applied to an explosive that has had an agent added to stabilize or desensitize it. Sometimes this is desirable, to enable handling or to reduce the rate of combustion. Typical phlegmatizing agents include wax, paper, water, and paraffin. Some phlegmatizing agents are combustible themselves and others may evaporate over time. Normally, only explosives that may be cast are phlegmatized.

A4.5 Hazards

Fire or explosion:

- (a) May be ignited by heat sparks or flames.
- (b) Will burn when involved in a fire.
- (c) May explode from intense heating, shock, friction or contamination.
- (d) Keep material wet with water or treat as an explosive
- (e) Dried out material may explode when exposed to heat, flame, friction or shock. In this condition, treat as an explosive
- (f) Where packaging is damaged or broken, treat as an explosive
- (g) Fire may produce irritating, toxic, and/or corrosive gases.
- (h) Runoff may create fire or explosion hazard.
- (i) May form extremely sensitive compounds with heavy metals or their salts.

A4.6 Health and environment

- (a) Inhalation or contact with vapour arising from a fire may cause severe injury, burns or death.
- (b) Runoff from fire control or dilution water may pollute waterways.

A4.7 Ferrosilicon

Ferrosilicon varies in composition depending on the method of manufacture and the intended use of the material. It is used in a number of pyrometallurgical processes, and has also been used to produce hydrogen.

Ferrosilicon reacts with water to produce flammable hydrogen gas. Impurities in the ferrosilicon can also produce toxic phosphine and arsine gases and flammable acetylene gas on reaction with water. The reactivity of the ferrosilicon and the nature of the gases produced on reaction with water vary with the composition of the ferrosilicon. Generally, the mixture of gases generated will always be flammable, but may also be toxic.

A4.8 Metallic powders

Metallic powders constitute a special danger because many are capable of burning fiercely and reacting violently with water. Many are a dust explosion hazard and so fires involving them should be fought without disturbing the bulk of the material. Specialized fire fighting techniques and fire extinguishing agents may be required.

The use of usual extinguishing agents such as water or carbon dioxide may increase the blaze or lead to explosions in some cases.

A4.9 Nitrocellulose

A4.9.1 General

Nitrocellulose ('NC') is also known as cellulose nitrate ('CN'). Other names are guncotton (pyroxylin) and collodion cotton (colloxylin). It is a white cotton-like substance, and the commercial material comes as white, fluffy flakes. As the name 'guncotton' may suggest, nitrocellulose is highly flammable and burns very rapidly.

Nitrocellulose is used:

- (a) In the manufacture of high-gloss automotive paints.
- (b) In furniture lacquers.
- (c) In printing inks.
- (d) As a component of 'smokeless powder' propellants for firearms.
- (e) As a component of cordite, used as propellant for artillery and rockets.

Cellulose is the main constituent of all plant cells and is found particularly in fibrous materials like cotton, flax, hemp, straw and wood. Nitrocellulose is prepared by treating cellulose with 'nitrating acid', a mixture of nitric acid and sulphuric acid.

If the cellulose is treated to give a nitrogen content of 12.5% to 13.5%, the nitrocellulose produced is called 'guncotton' and can be used as a propellant and explosive. If the nitrocellulose contains 10.5% to 12.5% nitrogen, it is called collodion cotton. The nitrocellulose used in the manufacture of paints and lacquers contains 11.5% to 12.5% nitrogen.

Collodion cotton, with a lower nitrogen content, is less explosive than guncotton. It was used for making celluloid, one of the earliest plastics. Collodion, a solution of collodion cotton in a mixture of alcohol and ether, was originally used to prepare negatives on glass plates for photography.

A4.9.2 Hazards of Nitrocellulose

Nitrocellulose, when ignited, burns very rapidly, and may explode if the material is confined. Toxic nitrogen oxides will be produced in the fire.

Dry nitrocellulose can be ignited very easily—by flame, heat, shock, impact, friction, sparks or static electricity.

The product supplied for commercial use is wetted with 25% to 35% of either water or alcohol (ethanol or isopropanol) to reduce the risk of ignition. Containers of nitrocellulose must be kept sealed to prevent the product drying out.

If nitrocellulose is burning, copious amounts of water are required to fight the fire. Foam is not recommended, as it does not provide enough cooling effect.

A4.9.3 Dangerous Goods Classifications

The United Nations Classification depends on nitrogen content and percentage of wetting agent.

Nitrocellulose, dry or wetted with less than 25% water or alcohol, is classified as a Class 1 Explosive with Classification Code 1.1D (mass explosion hazard) UN 0340.

Nitrocellulose (with nitrogen content greater than 12.6%), wetted with not less than 25% alcohol, is classified as a Class 1 Explosive with Classification Code 1.3C. UN 0342.

Nitrocellulose with not more than 12.6% nitrogen content, wetted with water (UN 2555) or with alcohol (UN 2556) is classified as a Class 4.1 Flammable Solid.

A4.10 Phosphorus—red and white/yellow

White (sometimes called ‘yellow’) phosphorus is a waxy pale yellowish-white solid, often seen as pellets. It ignites spontaneously in air at normal room temperatures. It burns brightly, producing a dense cloud of choking corrosive phosphorus oxides which will react with water to produce acids. In most situations fires may be fought with water.

White phosphorus is usually transported and stored in sealed airtight containers, either under water or inert gas. Containers should be monitored for corrosion, and stock rotated to minimize the risk of loss of water and fire. Storage of containers (e.g. drums) under water in a bund or similar may be prudent, as may monitoring and adjustment of pH to minimize corrosion.

Red phosphorus is a reddish/maroon damp looking powdery solid, often transported and supplied in drums. Whilst it is not spontaneously combustible like the white allotrope, it burns in a similar fashion once ignited, generating a dense cloud of phosphorus oxides fumes.

A4.11 Self-reactive substances

The decomposition of self-reactive substances can be initiated by heat, contact with catalytic impurities (e.g. acids, heavy-metal compounds, bases), friction or impact. The rate of decomposition increases with temperature and varies with the substance. Decomposition, particularly if no ignition occurs, may result in the evolution of toxic gases or vapours. For certain self-reactive substances, the temperature must be controlled. Some self-reactive substances may decompose explosively, particularly if confined. This characteristic may be modified by the addition of diluents or by the use of appropriate packagings. Some self-reactive substances burn vigorously. Self-reactive substances are, for example, some compounds of the types listed below:

- (a) Aliphatic azo compounds (-C-N=N-C-); and
- (b) Organic azides (-C-N_3); and
- (c) Diazonium salts ($\text{-CN}_2\text{+Z-}$); and

- (d) N-nitroso compounds ($-N-N=O$); and
- (e) Aromatic sulphohydrazides ($-SO_2-NH-NH_2$).

This list is not exhaustive and substances with other reactive groups and some mixtures of substances may have similar properties.

A4.12 Sulphur—solid and molten

Sulphur is a yellow solid which is used in forms ranging from large lumps to very fine dust. Molten sulphur is also used in some industrial processes.

Sulphur burns to produce sulphur dioxide, which is a toxic, corrosive gas. Sulphur fires have a pale flame which can be difficult or impossible to see, especially in bright light, such as daylight. Stockpile fires can sometimes be seen as melting patches on a sulphur stockpile, rather than as flames.

Whilst fires involving sulphur can often be extinguished with water, finely divided sulphur presents a dust explosion risk, so care must be used in application of water to fires. Water jets or sprays may stir up dust clouds and lead to dust explosions. Mechanical handling and transfer of sulphur lumps, prills or pastilles may generate sulphur dust of Division 4.1 with attendant fire and dust explosion risks, even though the bulk of the sulphur is not Class 4.

Transfer and handling of sulphur may lead to generation of static electrical charge. This should be considered in facility design, construction and maintenance.

A4.13 Xanthates

Xanthates are produced by reaction of an alcohol, a metal hydroxide and carbon disulphide. They are widely used in mineral processing operations.

Xanthates can decompose to release carbon disulfide vapour, which is both flammable and toxic. As a result, there may be a hazardous zone associated with solid xanthate storage and handling operations. Moist xanthates can decompose exothermically and self ignite, so containers need to be kept sealed in a dry place and away from water.

A5 DANGEROUS GOODS OF CLASS 4

Table A1 lists dangerous goods of Class 4 and includes dangerous goods information for those materials (UN Number, Proper Shipping Name and description, Division, Subsidiary Risk and Packing Group).

TABLE A1
LIST OF CLASS 4 DANGEROUS GOODS

UN No.	Name and description	Class or Division	Subsidiary Risk	UN Packing Group
Division 4.1				
Flammable solids, desensitized explosives and self-reactive substances and related substances				
Flammable solids without subsidiary risk.				
Substances with weakly nitrated nitrocellulose				
1324	FILMS, NITROCELLULOSE BASE, gelatin coated, except scrap	4.1		III
1353	FIBRES or FABRICS IMPREGNATED WITH WEAKLY NITRATED NITROCELLULOSE, N.O.S.	4.1		III
2000	CELLULOID in block, rods, rolls, sheets, tubes, etc., except scrap	4.1		III
3270	NITROCELLULOSE MEMBRANE FILTERS, with not more than 12.6% nitrogen, by dry mass	4.1		II
Other flammable solids, organic, including articles				
1312	BORNEOL	4.1		III
1325	FLAMMABLE SOLID, ORGANIC, N.O.S.	4.1		II
1325	FLAMMABLE SOLID, ORGANIC, N.O.S.	4.1		III
1327	HAY, STRAW or BHUSA	4.1		
1328	HEXA METHYLENE-TETRAMINE	4.1		III
1331	MATCHES, 'STRIKE ANYWHERE'	4.1		III
1332	METALDEHYDE	4.1		III
1334	NAPHTHALENE, CRUDE or NAPHTHALENE, REFINED	4.1		III
1345	RUBBER SCRAP or RUBBER SHODDY, powdered or granulated, not exceeding 840 microns and rubber content exceeding 45%	4.1		II
1944	MATCHES, SAFETY (book, card or strike on box)	4.1		III
1945	MATCHES, WAX 'VESTA'	4.1		III
2213	PARAFORMALDE HYDE	4.1		III
2254	MATCHES, FUSEE	4.1		III
2538	NITRONAPHTHALENE	4.1		III
2623	FIRELIGHTERS, SOLID with flammable liquid	4.1		III
2687	DICYCLOHEXYL-AMMONIUM NITRITE	4.1		III
2717	CAMPHOR, synthetic	4.1		III
3175	SOLIDS CONTAINING FLAMMABLE LIQUID, N.O.S.	4.1		II
3360	FIBRES, VEGETABLE, DRY	4.1		
Flammable solids, organic, molten				
2304	NAPHTHALENE, MOLTEN	4.1		III
3176	FLAMMABLE SOLID, ORGANIC, MOLTEN, N.O.S.	4.1		II
3176	FLAMMABLE SOLID, ORGANIC, MOLTEN, N.O.S.	4.1		III

(continued)

TABLE A1 (continued)

UN No.	Name and description	Class or Division	Subsidiary Risk	UN Packing Group
Flammable solids, inorganic. Metal salts of organic compounds				
1313	CALCIUM RESINATE	4.1		III
1314	CALCIUM RESINATE, FUSED	4.1		III
1318	COBALT RESINATE, PRECIPITATED	4.1		III
1330	MANGANESE RESINATE	4.1		III
2001	COBALT NAPHTHENATES, POWDER	4.1		III
2714	ZINC RESINATE	4.1		III
2715	ALUMINIUM RESINATE	4.1		III
3181	METAL SALTS OF ORGANIC COMPOUNDS, FLAMMABLE, N.O.S.	4.1		II
3181	METAL SALTS OF ORGANIC COMPOUNDS, FLAMMABLE, N.O.S.	4.1		III
Metals in flammable form				
1309	ALUMINIUM POWDER, COATED	4.1		II
1309	ALUMINIUM POWDER, COATED	4.1		III
1323	FERROCERIUM	4.1		II
1326	HAFNIUM POWDER, WETTED with not less than 25% water (a visible excess of water must be present) (a) mechanically produced, particle size less than 53 microns; (b) chemically produced, particle size less than 840 microns	4.1		II
1333	CERIUM, slabs, ingots or rods	4.1		II
1352	TITANIUM POWDER, WETTED with not less than 25% water (a visible excess of water must be present) (a) mechanically produced, particle size less than 53 microns; (b) chemically produced particle size less than 840 microns	4.1		II
1358	ZIRCONIUM POWDER, WETTED with not less than 25% water (a visible excess of water must be present) (a) mechanically produced, particle size less than 53 microns; (b) chemically produced particle size less than 840 microns	4.1		II
1869	MAGNESIUM or MAGNESIUM ALLOYS with more than 50% magnesium in pellets, turnings or ribbons	4.1		III
2858	ZIRCONIUM, DRY, coiled wire, finished metal sheets, strip (thinner than 254 microns but not thinner than 18 microns)	4.1		III
2878	TITANIUM SPONGE GRANULES or TITANIUM SPONGE POWDERS	4.1		III
Metals in flammable form				
3089	METAL POWDER, FLAMMABLE, N.O.S.	4.1		II
3089	METAL POWDER, FLAMMABLE, N.O.S.	4.1		III
Metal hydrides				
1437	ZIRCONIUM HYDRIDE	4.1		II
1871	TITANIUM HYDRIDE	4.1		II

(continued)

TABLE A1 (continued)

UN No.	Name and description	Class or Division	Subsidiary Risk	UN Packing Group
3182	METAL HYDRIDES, FLAMMABLE, N.O.S.	4.1		II
3182	METAL HYDRIDES, FLAMMABLE, N.O.S.	4.1		III
Molten substances, inorganic				
2448	SULPHUR, MOLTEN	4.1		III
Other flammable solids, inorganic				
1338	PHOSPHORUS, AMORPHOUS	4.1		III
1339	PHOSPHORUS HEPTASULPHIDE, free from yellow and white phosphorus	4.1		II
1341	PHOSPHORUS SESQUISULPHIDE, free from yellow and white phosphorus	4.1		II
1343	PHOSPHORUS TRISULPHIDE, free from yellow and white phosphorus	4.1		II
1346	SILICON POWDER, AMORPHOUS	4.1		III
1350	SULPHUR	4.1		III
2989	LEAD PHOSPHITE, DIBASIC	4.1		II
2989	LEAD PHOSPHITE, DIBASIC	4.1		III
3178	FLAMMABLE SOLID, INORGANIC, N.O.S.	4.1		II
3178	FLAMMABLE SOLID, INORGANIC, N.O.S.	4.1		III
Flammable solids with subsidiary risk.				
Flammable solids, oxidizing				
3097	FLAMMABLE SOLID, OXIDIZING, N.O.S.	4.1	5.1	II
3097	FLAMMABLE SOLID, OXIDIZING, N.O.S.	4.1	5.1	III
Flammable solids, toxic, organic				
2926	FLAMMABLE SOLID, TOXIC, ORGANIC, N.O.S.	4.1	6.1	II
2926	FLAMMABLE SOLID, TOXIC, ORGANIC, N.O.S.	4.1	6.1	III
Flammable solids, toxic, inorganic				
1868	DECABORANE	4.1	6.1	II
3179	FLAMMABLE SOLID, TOXIC, INORGANIC, N.O.S.	4.1	6.1	II
3179	FLAMMABLE SOLID, TOXIC, INORGANIC, N.O.S.	4.1	6.1	III
Flammable solids, corrosive, organic				
2925	FLAMMABLE SOLID, CORROSIVE, ORGANIC, N.O.S.	4.1	8	II
2925	FLAMMABLE SOLID, CORROSIVE, ORGANIC, N.O.S.	4.1	8	III
Flammable solids, corrosive, inorganic				
3180	FLAMMABLE SOLID, CORROSIVE, INORGANIC, N.O.S.	4.1	8	II
3180	FLAMMABLE SOLID, CORROSIVE, INORGANIC, N.O.S.	4.1	8	III
Desensitized explosives				
1310	AMMONIUM PICRATE, WETTED with not less than 10% water, by mass	4.1		I

(continued)

TABLE A1 (continued)

UN No.	Name and description	Class or Division	Subsidiary Risk	UN Packing Group
1322	"DINITRO RESORCINOL, WETTED with not less than 15% water, by mass"	4.1		I
1336	NITROGUANIDINE (PICRITE), WETTED with not less than 20% water, by mass	4.1		I
1337	NITROSTARCH, WETTED with not less than 20% water, by mass	4.1		I
1344	TRINITROPHENOL, WETTED with not less than 30% water, by mass	4.1		I
1347	SILVER PICRATE, WETTED with not less than 30% water, by mass	4.1		I
1349	SODIUM PICRAMATE, WETTED with not less than 20% water, by mass	4.1		I
1354	"TRINITRO BENZENE, WETTED with not less than 30% water, by mass"	4.1		I
1355	TRINITROBENZOIC ACID, WETTED with not less than 30% water, by mass	4.1		I
1356	"TRINITRO TOLUENE, WETTED with not less than 30% water, by mass"	4.1		I
1357	UREA NITRATE, WETTED with not less than 20% water, by mass	4.1		I
1517	ZIRCONIUM PICRAMATE, WETTED with not less than 20% water, by mass	4.1		I
2555	NITROCELLULOSE WITH WATER (not less than 25% water, by mass)	4.1		II
2556	NITROCELLULOSE WITH ALCOHOL (not less than 25% alcohol, by mass, and not more than 12.6% nitrogen, by dry mass)	4.1		II
2557	NITROCELLULOSE, with not more than 12.6% nitrogen, by dry mass, MIXTURE WITH or WITHOUT PLASTICIZER, WITH or WITHOUT PIGMENT	4.1		II
2852	DIPICRYL SULPHIDE, WETTED with not less than 10% water, by mass	4.1		I
2907	ISOSORBIDE DINITRATE MIXTURE with not less than 60% lactose, mannose, starch or calcium hydrogen phosphate	4.1		II
2956	5-tert-BUTYL-2,4,6-TRINITRO-m-XYLENE (MUSK XYLENE)	4.1		III
3317	2-AMINO-4,6-DINITROPHENOL, WETTED with not less than 20% water, by mass	4.1		I
3319	NITROGLYCERIN MIXTURE, DESENSITIZED, SOLID, N.O.S. with more than 2% but not more than 10% nitroglycerin, by mass	4.1		II
3344	PENTAERYTHRIT TETRANITRATE MIXTURE, DESENSITIZED, SOLID, N.O.S. with more than 10% but not more than 20% PETN, by mass	4.1		II
3364	TRINITROPHENOL (PICRIC ACID), WETTED, with not less than 10% water by mass	4.1		I

(continued)

TABLE A1 (continued)

UN No.	Name and description	Class or Division	Subsidiary Risk	UN Packing Group
3365	TRINITROCHLOROBENZENE (PICRYL CHLORIDE), WETTED, with not less than 10% water by mass	4.1		I
3366	TRINITROTOLUENE (TNT), WETTED, with not less than 10% water by mass	4.1		I
3367	TRINITROBENZENE, WETTED, with not less than 10% water by mass	4.1		I
3368	TRINITROBENZOIC ACID, WETTED, with not less than 10% water by mass	4.1		I
3370	UREA NITRATE, WETTED, with not less than 10% water by mass	4.1		I
3376	4-NITROPHENYL-HYDRAZINE, with not less than 30 % water, by mass	4.1		I
3380	DESENSITIZED EXPLOSIVE, SOLID, N.O.S.	4.1		I
3474	1-HYDROXYBENZOTRIAZOLE, ANHYDROUS, WETTED with not less than 20% water, by mass	4.1		I
Desensitized explosives, toxic				
1320	DINITROPHENOL, WETTED with not less than 15% water, by mass	4.1	6.1	I
1321	DINITRO PHENOLATES, WETTED with not less than 15% water, by mass	4.1	6.1	I
1348	SODIUM DINITRO-o-CRESOLATE, WETTED with not less than 15% water, by mass	4.1	6.1	I
1571	BARIUM AZIDE, WETTED with not less than 50% water, by mass	4.1	6.1	I
3369	SODIUM DINITRO-o-CRESOLATE, WETTED, with not less than 10% water by mass	4.1		I
Self-reactive substances				
3241	2-BROMO-2-NITROPROPANE-1,3-DIOL	4.1		III
3242	AZODICARBONAMIDE	4.1		II
3251	ISOSORBIDE-5-MONONITRATE	4.1		III
Self-reactive substances, not temperature controlled				
3221	SELF-REACTIVE LIQUID TYPE B	4.1		
3222	SELF-REACTIVE SOLID TYPE B	4.1		
3223	SELF-REACTIVE LIQUID TYPE C	4.1		
3224	SELF-REACTIVE SOLID TYPE C	4.1		
3225	SELF-REACTIVE LIQUID TYPE D	4.1		
3226	SELF-REACTIVE SOLID TYPE D	4.1		
3227	SELF-REACTIVE LIQUID TYPE E	4.1		
3228	SELF-REACTIVE SOLID TYPE E	4.1		
3229	SELF-REACTIVE LIQUID TYPE F	4.1		
3230	SELF-REACTIVE SOLID TYPE F	4.1		

(continued)

TABLE A1 (continued)

UN No.	Name and description	Class or Division	Subsidiary Risk	UN Packing Group
3231	SELF-REACTIVE LIQUID TYPE B, TEMPERATURE CONTROLLED	4.1		
3232	SELF-REACTIVE SOLID TYPE B, TEMPERATURE CONTROLLED	4.1		
3233	SELF-REACTIVE LIQUID TYPE C, TEMPERATURE CONTROLLED	4.1		
3234	SELF-REACTIVE SOLID TYPE C, TEMPERATURE CONTROLLED	4.1		
3235	SELF-REACTIVE LIQUID TYPE D, TEMPERATURE CONTROLLED	4.1		
3236	SELF-REACTIVE SOLID TYPE D, TEMPERATURE CONTROLLED	4.1		
Self-reactive substances, temperature controlled				
3237	SELF-REACTIVE LIQUID TYPE E, TEMPERATURE CONTROLLED	4.1		
3238	SELF-REACTIVE SOLID TYPE E, TEMPERATURE CONTROLLED	4.1		
3239	SELF-REACTIVE LIQUID TYPE F, TEMPERATURE CONTROLLED	4.1		
3240	SELF-REACTIVE SOLID TYPE F, TEMPERATURE CONTROLLED	4.1		
Division 4.2				
Substances liable to spontaneous combustion.				
Substances liable to spontaneous combustion, without subsidiary risk.				
Organic liquids				
2845	PYROPHORIC LIQUID, ORGANIC, N.O.S.	4.2		I
3183	SELF-HEATING LIQUID, ORGANIC, N.O.S.	4.2		II
3183	SELF-HEATING LIQUID, ORGANIC, N.O.S.	4.2		III
3254	TRIBUTYLPHOSPHANE	4.2		I
Organic solids.				
Substances with oil				
1364	COTTON WASTE, OILY	4.2		III
1373	FIBRES or FABRICS, ANIMAL or VEGETABLE or SYNTHETIC, N.O.S. with oil	4.2		III
1379	PAPER, UNSATURATED OIL TREATED, incompletely dried (including carbon paper)	4.2		III
1856	RAGS, OILY	4.2		
Plastics, nitrocellulose-based				
2002	CELLULOID, SCRAP	4.2		III
2006	PLASTICS, NITROCELLULOSE-BASED, SELF-HEATING, N.O.S.	4.2		III

(continued)

TABLE A1 (continued)

UN No.	Name and description	Class or Division	Subsidiary Risk	UN Packing Group
Other organic solids				
1361	CARBON, animal or vegetable origin	4.2		II
1361	CARBON, animal or vegetable origin	4.2		III
1362	CARBON, ACTIVATED	4.2		III
1363	COPRA	4.2		III
1365	COTTON, WET	4.2		III
1369	p-NITROSODI-METHYLANILINE	4.2		II
1372	FIBRES, ANIMAL or FIBRES, VEGETABLE burnt, wet or damp	4.2		III
1374	FISH MEAL (FISH SCRAP), UNSTABILIZED	4.2		II
1386	SEED CAKE with more than 1.5% oil and not more than 11% moisture	4.2		III
1387	WOOL WASTE, WET	4.2		III
1857	TEXTILE WASTE, WET	4.2		III
2217	SEED CAKE with not more than 1.5% oil and not more than 11% moisture	4.2		III
2846	PYROPHORIC SOLID, ORGANIC, N.O.S.	4.2		I
2940	9-PHOSPHABICYCLO-NONANES (CYCLOOCTADIENE PHOSPHINES)	4.2		II
3088	SELF-HEATING SOLID, ORGANIC, N.O.S.	4.2		II
3088	SELF-HEATING SOLID, ORGANIC, N.O.S.	4.2		III
3313	ORGANIC PIGMENTS, SELF-HEATING	4.2		II
3313	ORGANIC PIGMENTS, SELF-HEATING	4.2		III
3341	THIOUREA DIOXIDE	4.2		II
3341	THIOUREA DIOXIDE	4.2		III
3342	XANTHATES	4.2		II
3342	XANTHATES	4.2		III
Inorganic liquids				
3186	SELF-HEATING LIQUID, INORGANIC, N.O.S.	4.2		II
3186	SELF-HEATING LIQUID, INORGANIC, N.O.S.	4.2		III
3194	PYROPHORIC LIQUID, INORGANIC, N.O.S.	4.2		I
Inorganic solids.				
Metals or alloys				
1378	METAL CATALYST, WETTED with a visible excess of liquid	4.2		II
1383	PYROPHORIC METAL, N.O.S. or PYROPHORIC ALLOY, N.O.S.	4.2		I
1854	BARIUM ALLOYS, PYROPHORIC	4.2		I
1855	CALCIUM, PYROPHORIC or CALCIUM ALLOYS, PYROPHORIC	4.2		I
2008	ZIRCONIUM POWDER, DRY	4.2		I

(continued)

TABLE A1 (continued)

UN No.	Name and description	Class or Division	Subsidiary Risk	UN Packing Group
2008	ZIRCONIUM POWDER, DRY	4.2		II
2008	ZIRCONIUM POWDER, DRY	4.2		III
2009	ZIRCONIUM, DRY, finished sheets, strip or coiled wire	4.2		III
2545	HAFNIUM POWDER, DRY	4.2		I
2545	HAFNIUM POWDER, DRY	4.2		II
2545	HAFNIUM POWDER, DRY	4.2		III
2546	TITANIUM POWDER, DRY	4.2		I
2546	TITANIUM POWDER, DRY	4.2		II
2546	TITANIUM POWDER, DRY	4.2		III
2881	METAL CATALYST, DRY	4.2		I
2881	METAL CATALYST, DRY	4.2		II
2881	METAL CATALYST, DRY	4.2		III
3189	METAL POWDER, SELF-HEATING, N.O.S.	4.2		II
3189	METAL POWDER, SELF-HEATING, N.O.S.	4.2		III
Alkaline earth metal alcoholates				
3205	ALKALINE EARTH METAL ALCOHOLATES, N.O.S.	4.2		II
3205	ALKALINE EARTH METAL ALCOHOLATES, N.O.S.	4.2		III
Other inorganic solids				
1376	IRON OXIDE, SPENT or IRON SPONGE, SPENT obtained from coal gas purification	4.2		III
1382	POTASSIUM SULPHIDE, ANHYDROUS or POTASSIUM SULPHIDE with less than 30% water of crystallization	4.2		II
1384	SODIUM DITHIONITE (SODIUM HYDROSULPHITE)	4.2		II
1385	SODIUM SULPHIDE, ANHYDROUS or SODIUM SULPHIDE with less than 30% water of crystallization	4.2		II
1923	CALCIUM DITHIONITE (CALCIUM HYDROSULPHITE)	4.2		II
1929	POTASSIUM DITHIONITE (POTASSIUM HYDROSULPHITE)	4.2		II
1932	ZIRCONIUM SCRAP	4.2		III
2004	MAGNESIUM DIAMIDE	4.2		II
2318	SODIUM HYDROSULPHIDE with less than 25% water of crystallization	4.2		II
2793	FERROUS METAL BORINGS, SHAVINGS, TURNINGS or CUTTINGS in a form liable to self-heating	4.2		III
3174	TITANIUM DISULPHIDE	4.2		III
3190	SELF-HEATING SOLID, INORGANIC, N.O.S.	4.2		II
3190	SELF-HEATING SOLID, INORGANIC, N.O.S.	4.2		III
3200	PYROPHORIC SOLID, INORGANIC, N.O.S.	4.2		I

(continued)

TABLE A1 (continued)

UN No.	Name and description	Class or Division	Subsidiary Risk	UN Packing Group
Organometallic substances.				
2005	MAGNESIUM DIPHENYL	4.2		I
3391	ORGANOMETALLIC SUBSTANCE, SOLID, PYROPHORIC	4.2		I
3392	ORGANOMETALLIC SUBSTANCE, LIQUID, PYROPHORIC	4.2		I
3400	ORGANOMETALLIC SUBSTANCE, SOLID, SELF-HEATING	4.2		II
3400	ORGANOMETALLIC SUBSTANCE, SOLID, SELF-HEATING	4.2		III
Substances liable to spontaneous combustion, with subsidiary risk.				
Organometallic substances, water-reactive				
1366	DIETHYLZINC	4.2	4.3	I
1370	DIMETHYLZINC	4.2	4.3	I
2445	LITHIUM ALKYL, LIQUID	4.2	4.3	I
3051	ALUMINIUM ALKYL	4.2	4.3	I
3052	ALUMINIUM ALKYL HALIDES, LIQUID	4.2	4.3	I
3053	MAGNESIUM ALKYL	4.2	4.3	I
3076	ALUMINIUM ALKYL HYDRIDES	4.2	4.3	I
3393	ORGANOMETALLIC SUBSTANCE, SOLID, PYROPHORIC, WATER-REACTIVE	4.2	4.3	I
3394	ORGANOMETALLIC SUBSTANCE, LIQUID, PYROPHORIC, WATER-REACTIVE	4.2	4.3	I
3433	LITHIUM ALKYL, SOLID	4.2	4.3	I
3461	ALUMINIUM ALKYL HALIDES, SOLID	4.2	4.3	I
Other substances.				
2210	MANEB or MANEB PREPARATION with not less than 60% maneb	4.2	4.3	III
2870	ALUMINIUM BOROHYDRIDE IN DEVICES	4.2	4.3	I
2870	ALUMINIUM BOROHYDRIDE	4.2	4.3	I
Self-heating solids, oxidizing				
3127	SELF-HEATING SOLID, OXIDIZING, N.O.S.	4.2	5.1	II
3127	SELF-HEATING SOLID, OXIDIZING, N.O.S.	4.2	5.1	III
Substances liable to spontaneous combustion, toxic.				
Organic liquids				
3184	SELF-HEATING LIQUID, TOXIC, ORGANIC, N.O.S.	4.2	6.1	II
3184	SELF-HEATING LIQUID, TOXIC, ORGANIC, N.O.S.	4.2	6.1	III
Organic solids				
3128	SELF-HEATING SOLID, TOXIC, ORGANIC, N.O.S.	4.2	6.1	II
3128	SELF-HEATING SOLID, TOXIC, ORGANIC, N.O.S.	4.2	6.1	III

(continued)

TABLE A1 (continued)

UN No.	Name and description	Class or Division	Subsidiary Risk	UN Packing Group
Inorganic liquids.				
1380	PENTABORANE	4.2	6.1	I
1381	PHOSPHORUS, WHITE or YELLOW, DRY or UNDER WATER or IN SOLUTION	4.2	6.1	I
2447	PHOSPHORUS, WHITE, MOLTEN	4.2	6.1	I
3187	SELF-HEATING LIQUID, TOXIC, INORGANIC, N.O.S.	4.2	6.1	II
3187	SELF-HEATING LIQUID, TOXIC, INORGANIC, N.O.S.	4.2	6.1	III
Inorganic solids				
3191	SELF-HEATING SOLID, TOXIC, INORGANIC, N.O.S.	4.2	6.1	II
3191	SELF-HEATING SOLID, TOXIC, INORGANIC, N.O.S.	4.2	6.1	III
Substances liable to spontaneous combustion, corrosive.				
Organic liquids				
3185	SELF-HEATING LIQUID, CORROSIVE, ORGANIC, N.O.S.	4.2	8	II
3185	SELF-HEATING LIQUID, CORROSIVE, ORGANIC, N.O.S.	4.2	8	III
3255	tert-BUTYL HYPOCHLORITE	4.2	8	I
Organic solids				
3126	SELF-HEATING SOLID, CORROSIVE, ORGANIC, N.O.S.	4.2	8	II
3126	SELF-HEATING SOLID, CORROSIVE, ORGANIC, N.O.S.	4.2	8	III
Inorganic liquids				
3188	SELF-HEATING LIQUID, CORROSIVE, INORGANIC, N.O.S.	4.2	8	II
3188	SELF-HEATING LIQUID, CORROSIVE, INORGANIC, N.O.S.	4.2	8	III
Inorganic solids.				
Alkali metal alcoholates				
1431	SODIUM METHYLATE	4.2	8	II
3206	ALKALI METAL ALCOHOLATES, SELF-HEATING, CORROSIVE, N.O.S.	4.2	8	II
3206	ALKALI METAL ALCOHOLATES, SELF-HEATING, CORROSIVE, N.O.S.	4.2	8	III
Other inorganic solids				
2441	TITANIUM TRICHLORIDE, PYROPHORIC or TITANIUM TRICHLORIDE MIXTURE, PYROPHORIC	4.2	8	I
3192	SELF-HEATING SOLID, CORROSIVE, INORGANIC, N.O.S.	4.2	8	II
3192	SELF-HEATING SOLID, CORROSIVE, INORGANIC, N.O.S.	4.2	8	III

(continued)

TABLE A1 (continued)

UN No.	Name and description	Class or Division	Subsidiary Risk	UN Packing Group
Division 4.3 Substances which in contact with water emit flammable gases. (water-reactive substances)				
Water-reactive substances, without subsidiary risk.				
Liquids				
1389	ALKALI METAL AMALGAM, LIQUID	4.3		I
1391	ALKALI METAL DISPERSION or ALKALINE EARTH METAL DISPERSION	4.3		I
1392	ALKALINE EARTH METAL AMALGAM, LIQUID	4.3		I
1420	POTASSIUM METAL ALLOYS, LIQUID	4.3		I
1421	ALKALI METAL ALLOY, LIQUID, N.O.S.	4.3		I
1422	POTASSIUM SODIUM ALLOYS, LIQUID	4.3		I
3148	WATER-REACTIVE LIQUID, N.O.S.	4.3		I
3148	WATER-REACTIVE LIQUID, N.O.S.	4.3		II
3148	WATER-REACTIVE LIQUID, N.O.S.	4.3		III
Organometallic substances, liquid				
3398	ORGANOMETALLIC SUBSTANCE, LIQUID, WATER-REACTIVE	4.3		I
3398	ORGANOMETALLIC SUBSTANCE, LIQUID, WATER-REACTIVE	4.3		II
3398	ORGANOMETALLIC SUBSTANCE, LIQUID, WATER-REACTIVE	4.3		III
Solids.				
Alkali metals or alloys				
1407	CAESIUM	4.3		I
1415	LITHIUM	4.3		I
1423	RUBIDIUM	4.3		I
1428	SODIUM	4.3		I
2257	POTASSIUM	4.3		I
3401	ALKALI METAL AMALGAM, SOLID	4.3		I
3404	POTASSIUM SODIUM ALLOYS, SOLID	4.3		I
Alkali metal amides				
1390	ALKALI METAL AMIDES	4.3		II
Alkaline earth metals or alloys				
1393	ALKALINE EARTH METAL ALLOY, N.O.S.	4.3		II
1400	BARIUM	4.3		II
1401	CALCIUM	4.3		II
2950	MAGNESIUM GRANULES, COATED, particle size not less than 149 microns	4.3		III
3402	ALKALINE EARTH METAL AMALGAM, SOLID	4.3		I
3403	POTASSIUM METAL ALLOYS, SOLID	4.3		I

(continued)

TABLE A1 (continued)

UN No.	Name and description	Class or Division	Subsidiary Risk	UN Packing Group
Other metallic substances				
1396	ALUMINIUM POWDER, UNCOATED	4.3		II
1396	ALUMINIUM POWDER, UNCOATED	4.3		III
1398	ALUMINIUM SILICON POWDER, UNCOATED	4.3		III
1435	ZINC ASHES	4.3		III
3078	CERIUM, turnings or gritty powder	4.3		II
3170	ALUMINIUM SMELTING BY-PRODUCTS or ALUMINIUM REMELTING BY-PRODUCTS	4.3		II
3170	ALUMINIUM SMELTING BY-PRODUCTS or ALUMINIUM REMELTING BY-PRODUCTS	4.3		III
3208	METALLIC SUBSTANCE, WATER REACTIVE, N.O.S.	4.3		I
3208	METALLIC SUBSTANCE, WATER REACTIVE, N.O.S.	4.3		II
3208	METALLIC SUBSTANCE, WATER-REACTIVE, N.O.S.	4.3		III
Metal hydrides				
1404	CALCIUM HYDRIDE	4.3		I
1409	METAL HYDRIDES, WATER-REACTIVE, N.O.S.	4.3		I
1409	METAL HYDRIDES, WATER-REACTIVE, N.O.S.	4.3		II
1410	LITHIUM ALUMINIUM HYDRIDE	4.3		I
1413	LITHIUM BOROHYDRIDE	4.3		I
1414	LITHIUM HYDRIDE	4.3		I
1426	SODIUM BOROHYDRIDE	4.3		I
1427	SODIUM HYDRIDE	4.3		I
1870	POTASSIUM BOROHYDRIDE	4.3		I
2010	MAGNESIUM HYDRIDE	4.3		I
2463	ALUMINIUM HYDRIDE	4.3		I
2805	LITHIUM HYDRIDE, FUSED SOLID	4.3		II
2835	SODIUM ALUMINIUM HYDRIDE	4.3		II
Organometallic substances, solid				
3395	ORGANOMETALLIC SUBSTANCE, SOLID, WATER-REACTIVE	4.3		I
3395	ORGANOMETALLIC SUBSTANCE, SOLID, WATER-REACTIVE	4.3		II
3395	ORGANOMETALLIC SUBSTANCE, SOLID, WATER-REACTIVE	4.3		III
Other water-reactive solids				
1394	ALUMINIUM CARBIDE	4.3		II
1402	CALCIUM CARBIDE	4.3		I
1402	CALCIUM CARBIDE	4.3		II
1403	CALCIUM CYANAMIDE with more than 0.1% calcium carbide	4.3		III

(continued)

TABLE A1 (continued)

UN No.	Name and description	Class or Division	Subsidiary Risk	UN Packing Group
1405	CALCIUM SILICIDE	4.3		II
1405	CALCIUM SILICIDE	4.3		III
1417	LITHIUM SILICON	4.3		II
2624	MAGNESIUM SILICIDE	4.3		II
2806	LITHIUM NITRIDE	4.3		I
2813	WATER-REACTIVE SOLID, N.O.S.	4.3		I
2813	WATER-REACTIVE SOLID, N.O.S.	4.3		II
2813	WATER-REACTIVE SOLID, N.O.S.	4.3		III
2830	LITHIUM FERROSILICON	4.3		II
2844	CALCIUM MANGANESE SILICON	4.3		III
2968	MANEB, STABILIZED or MANEB PREPARATION, STABILIZED against self-heating	4.3		III
Articles.				
3292	BATTERIES, CONTAINING SODIUM, or CELLS, CONTAINING SODIUM	4.3		II
Water-reactive substances, with subsidiary risk.				
Water-reactive liquids, flammable				
1411	LITHIUM ALUMINIUM HYDRIDE, ETHEREAL	4.3	3	I
1928	METHYL MAGNESIUM BROMIDE IN ETHYL ETHER	4.3	3	I
3399	ORGANOMETALLIC SUBSTANCE, LIQUID, WATER-REACTIVE, FLAMMABLE	4.3	3	I
3399	ORGANOMETALLIC SUBSTANCE, LIQUID, WATER-REACTIVE, FLAMMABLE	4.3	3	II
3399	ORGANOMETALLIC SUBSTANCE, LIQUID, WATER-REACTIVE, FLAMMABLE	4.3	3	III
Water-reactive solids, flammable				
1340	PHOSPHORUS PENTASULPHIDE, free from yellow and white phosphorus	4.3	4.1	II
3132	WATER-REACTIVE SOLID, FLAMMABLE, N.O.S.	4.3	4.1	I
3132	WATER-REACTIVE SOLID, FLAMMABLE, N.O.S.	4.3	4.1	II
3132	WATER-REACTIVE SOLID, FLAMMABLE, N.O.S.	4.3	4.1	III
3396	ORGANOMETALLIC SUBSTANCE, SOLID, WATER-REACTIVE, FLAMMABLE	4.3	4.1	I
3396	ORGANOMETALLIC SUBSTANCE, SOLID, WATER-REACTIVE, FLAMMABLE	4.3	4.1	II
Water-reactive substances, self-heating.				
Metallic substances				
1418	MAGNESIUM POWDER or MAGNESIUM ALLOYS POWDER	4.3	4.2	I
1418	MAGNESIUM POWDER or MAGNESIUM ALLOYS POWDER	4.3	4.2	II

(continued)

TABLE A1 (continued)

UN No.	Name and description	Class or Division	Subsidiary Risk	UN Packing Group
1418	MAGNESIUM POWDER or MAGNESIUM ALLOYS POWDER	4.3	4.2	III
1436	ZINC POWDER or ZINC DUST	4.3	4.2	I
1436	ZINC POWDER or ZINC DUST	4.3	4.2	II
1436	ZINC POWDER or ZINC DUST	4.3	4.2	III
3209	METALLIC SUBSTANCE, WATER-REACTIVE, SELF-HEATING, N.O.S.	4.3	4.2	I
3209	METALLIC SUBSTANCE, WATER-REACTIVE, SELF-HEATING, N.O.S.	4.3	4.2	II
3209	METALLIC SUBSTANCE, WATER-REACTIVE, SELF-HEATING, N.O.S.	4.3	4.2	III
Other substances				
3135	WATER-REACTIVE SOLID, SELF-HEATING, N.O.S.	4.3	4.2	I
3135	WATER-REACTIVE SOLID, SELF-HEATING, N.O.S.	4.3	4.2	II
3135	WATER-REACTIVE SOLID, SELF-HEATING, N.O.S.	4.3	4.2	III
3397	ORGANOMETALLIC SUBSTANCE, SOLID, WATER-REACTIVE, SELF-HEATING	4.3	4.2	I
3397	ORGANOMETALLIC SUBSTANCE, SOLID, WATER-REACTIVE, SELF-HEATING	4.3	4.2	II
3397	ORGANOMETALLIC SUBSTANCE, SOLID, WATER-REACTIVE, SELF-HEATING	4.3	4.2	III
Water-reactive substances, oxidizing				
3133	WATER-REACTIVE SOLID, OXIDIZING, N.O.S.	4.3	5.1	II
3133	WATER-REACTIVE SOLID, OXIDIZING, N.O.S.	4.3	5.1	III
Water-reactive substances, toxic.				
Liquids				
3130	WATER-REACTIVE LIQUID, TOXIC, N.O.S.	4.3	6.1	I
3130	WATER-REACTIVE LIQUID, TOXIC, N.O.S.	4.3	6.1	II
3130	WATER-REACTIVE LIQUID, TOXIC, N.O.S.	4.3	6.1	III
Solids				
1360	CALCIUM PHOSPHIDE	4.3	6.1	I
1395	ALUMINIUM FERROSILICON POWDER	4.3	6.1	II
1397	ALUMINIUM PHOSPHIDE	4.3	6.1	I
1408	FERROSILICON with 30% or more but less than 90% silicon	4.3	6.1	III
1419	MAGNESIUM ALUMINIUM PHOSPHIDE	4.3	6.1	I
1432	SODIUM PHOSPHIDE	4.3	6.1	I
1433	STANNIC PHOSPHIDES	4.3	6.1	I
1714	ZINC PHOSPHIDE	4.3	6.1	I
2011	MAGNESIUM PHOSPHIDE	4.3	6.1	I
2012	POTASSIUM PHOSPHIDE	4.3	6.1	I

(continued)

TABLE A1 (continued)

UN No.	Name and description	Class or Division	Subsidiary Risk	UN Packing Group
2013	STRONTIUM PHOSPHIDE	4.3	6.1	I
3134	WATER-REACTIVE SOLID, TOXIC, N.O.S.	4.3	6.1	I
3134	WATER-REACTIVE SOLID, TOXIC, N.O.S.	4.3	6.1	II
3134	WATER-REACTIVE SOLID, TOXIC, N.O.S.	4.3	6.1	III
Water-reactive substances, corrosive.				
Liquids				
3129	WATER-REACTIVE LIQUID, CORROSIVE, N.O.S.	4.3	8	I
3129	WATER-REACTIVE LIQUID, CORROSIVE, N.O.S.	4.3	8	II
3129	WATER-REACTIVE LIQUID, CORROSIVE, N.O.S.	4.3	8	III
Solids.				
3131	WATER-REACTIVE SOLID, CORROSIVE, N.O.S.	4.3	8	I
3131	WATER-REACTIVE SOLID, CORROSIVE, N.O.S.	4.3	8	II
3131	WATER-REACTIVE SOLID, CORROSIVE, N.O.S.	4.3	8	III
Water-reactive liquids, flammable, corrosive.				
Chlorosilanes				
1183	ETHYLDICHLORO-SILANE	4.3	3, 8	I
1242	METHYLDI-CHLOROSILANE	4.3	3, 8	I
1295	TRICHLOROSILANE	4.3	3, 8	I
2988	CHLOROSILANES, WATER-REACTIVE, FLAMMABLE, CORROSIVE, N.O.S.	4.3	3, 8	I
Other substances				
2965	BORON TRIFLUORIDE DIMETHYL ETHERATE	4.3	3, 8	I
Substances With Class 4 Subrisk				
Oxidizing solids, flammable				
3137	OXIDIZING SOLID, FLAMMABLE, N.O.S.	5.1	4.1	I
Oxidizing solids, self-heating.				
3100	OXIDIZING SOLID, SELF-HEATING, N.O.S.	5.1	4.2	I
3100	OXIDIZING SOLID, SELF-HEATING, N.O.S.	5.1	4.2	II
Oxidizing solids, water-reactive				
3121	OXIDIZING SOLID, WATER-REACTIVE, N.O.S.	5.1	4.3	I
3121	OXIDIZING SOLID, WATER-REACTIVE, N.O.S.	5.1	4.3	II
Toxic solids, flammable				
1567	BERYLLIUM POWDER	6.1	4.1	II
1700	TEAR GAS CANDLES	6.1	4.1	II
2930	TOXIC SOLID, FLAMMABLE, ORGANIC, N.O.S.	6.1	4.1	I
2930	TOXIC SOLID, FLAMMABLE, ORGANIC, N.O.S.	6.1	4.1	II
Toxic substances, self-heating				
3124	TOXIC SOLID, SELF-HEATING, N.O.S.	6.1	4.2	I
3124	TOXIC SOLID, SELF-HEATING, N.O.S.	6.1	4.2	II

(continued)

TABLE A1 (continued)

UN No.	Name and description	Class or Division	Subsidiary Risk	UN Packing Group
Toxic liquids, water-reactive				
3123	TOXIC LIQUID, WATER-REACTIVE, N.O.S.	6.1	4.3	I
3123	TOXIC LIQUID, WATER-REACTIVE, N.O.S.	6.1	4.3	II
3385	TOXIC BY INHALATION LIQUID, WATER-REACTIVE, N.O.S. with an inhalation toxicity lower than or equal to 200 ml/m ³ and saturated vapour concentration greater than or equal to 500 LC50	6.1	4.3	I
3386	TOXIC BY INHALATION LIQUID, WATER-REACTIVE, N.O.S. with an inhalation toxicity lower than or equal to 1000 ml/m ³ and saturated vapour concentration greater than or equal to 10 LC50	6.1	4.3	I
Toxic solids, water-reactive				
3125	TOXIC SOLID, WATER-REACTIVE, N.O.S.	6.1	4.3	I
3125	TOXIC SOLID, WATER-REACTIVE, N.O.S.	6.1	4.3	II
Corrosive solids, flammable				
2921	CORROSIVE SOLID, FLAMMABLE, N.O.S.	8	4.1	I
2921	CORROSIVE SOLID, FLAMMABLE, N.O.S.	8	4.1	II
Corrosive liquids, self-heating				
3301	CORROSIVE LIQUID, SELF-HEATING, N.O.S.	8	4.2	I
3301	CORROSIVE LIQUID, SELF-HEATING, N.O.S.	8	4.2	II
Corrosive solids, self-heating				
3095	CORROSIVE SOLID, SELF-HEATING, N.O.S.	8	4.2	I
3095	CORROSIVE SOLID, SELF-HEATING, N.O.S.	8	4.2	II
Corrosive liquids, water-reactive				
3094	CORROSIVE LIQUID, WATER-REACTIVE, N.O.S.	8	4.3	I
3094	CORROSIVE LIQUID, WATER-REACTIVE, N.O.S.	8	4.3	II
Corrosive solids, water-reactive				
3096	CORROSIVE SOLID, WATER-REACTIVE, N.O.S.	8	4.3	I
3096	CORROSIVE SOLID, WATER-REACTIVE, N.O.S.	8	4.3	II

APPENDIX B
LIST OF REFERENCED AND RELATED DOCUMENTS
(Normative)

B1 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

- | | |
|---------|---|
| 1019 | Internal combustion engines—Spark emission control devices |
| 1210 | Pressure vessels |
| 1216 | Class labels for dangerous goods |
| 1319 | Safety signs for the occupational environment |
| 1530 | Methods for fire tests on building materials, components and structures |
| 1530.1 | Part 1: Combustibility test for materials |
| 1530.4 | Part 4: Fire-resistance test of elements of construction |
| 1668 | The use of mechanical ventilation and airconditioning in buildings |
| 1668.2 | Part 2: Ventilation design for indoor air contaminant control (excluding requirements for the health aspects of tobacco smoke exposure) |
| 1674 | Safety in welding and allied processes |
| 1674.1 | Part 1: Fire precautions |
| 1851 | Maintenance of fire protection systems and equipment |
| 1915 | Electrical equipment for explosive atmospheres—Battery-operated vehicles |
| 1940 | The storage and handling of flammable and combustible liquids |
| 2118 | Automatic fire sprinkler systems |
| 2118.1 | Part 1: General systems |
| 2359 | Powered industrial trucks |
| 2359.12 | Part 12: Hazardous areas |
| 2444 | Portable fire extinguishers and fire blankets—Selection and location |
| 3846 | The handling and transport of dangerous cargoes in port areas |
| 4775 | Emergency eyewash and shower equipment |

AS/NZS

- | | |
|--------|--|
| 1020 | The control of undesirable static electricity |
| 1337 | Personal eye protection (series) |
| 1680 | Interior lighting |
| 1680.1 | Part 1: General principles and recommendations |
| 1715 | Selection, use and maintenance of respiratory protective devices |
| 1716 | Respiratory protective devices |
| 1800 | Occupational protective helmets—Selection, care and use |
| 1801 | Occupational protective helmets |

- AS/NZS
- 2161 Occupational protective gloves (series)
 - 2210 Occupational protective footwear
 - 2210.1 Part 1: Guide to selection, care and use
 - 2210.2 Part 2: Test methods (ISO 20344:2004, MOD)
 - 2381 Electrical equipment for explosive gas atmospheres—Selection, installation and maintenance
 - 2381.1 Part 1: General requirements
 - 2865 Safe working in a confined space
 - 3000 Electrical installations (known as the Australian/New Zealand Wiring Rules)
 - 3711 Freight containers
 - 3711.1 Part 1: Classification, dimensions and ratings
 - 3711.6 Part 6: Tank containers
 - 3833 The storage and handling of mixed classes of dangerous goods, in packages and intermediate bulk containers
 - 60079 Explosive atmospheres (series)
 - 61241 Electrical apparatus for use in the presence of combustible dust (series)
 - 61241.0 Part 0: General requirements
 - 61241.1 Part 1: Protection by enclosures ‘tD’
- NZS
- 4303 Ventilation for acceptable indoor air quality
 - 4503 Hand operated fire fighting equipment for use in buildings
 - 4541 Automatic fire sprinkler systems
 - 4781 Code of practice for safety in welding and cutting
 - 5433 Transport of dangerous goods on land
 - 5433.1 Part 1: Technical information
 - 5433.2 Part 2: List of dangerous goods
 - 1530 Methods for fire tests on building materials, components and structures
 - 1530.1 Part 1: Combustibility test for materials
 - 1530.4 Part 4: Fire-resistance test of elements of construction
- AUSTRALIAN BUILDING CODES BOARD
- BCA Building Code of Australia
- HAZARDOUS SUBSTANCES (CLASSES 1 TO 5 CONTROLS) REGULATIONS 2001
- AUSTRALIAN HEALTH MINISTERS ADVISORY COUNCIL
- SUSDP Standard for the uniform scheduling of drugs and poisons
- POLICY PROPOSAL FOR WORKPLACE CHEMICALS MODEL REGULATIONS
- SAFE WORK AUSTRALIA
- (succeeding AUSTRALIAN SAFETY AND COMPENSATION COUNCIL and the NATIONAL OCCUPATIONAL HEALTH AND SAFETY COMMISSION (NOHSC):
- 1005 National Model Regulations for the Control of Workplace Hazardous Substances
 - 1008 Approved Criteria for Classifying Hazardous Substances
 - 1014 National Standard for the Control of Major Hazard Facilities
 - 1015 National Standard for the Control of Workplace Dangerous Goods

2011 National Code of Practice for the Preparation of Material Safety Data Sheets

2012 National Code of Practice for the Labelling of Workplace Substances

SAFE WORK AUSTRALIA

3009 Guidance Note for Placarding Stores for Dangerous Goods and Specified Hazardous Substances

INTERNATIONAL AIR TRANSPORT ASSOCIATION

Dangerous Goods Regulations

INTERNATIONAL CIVIL AVIATION ORGANIZATION

Technical Instructions for the Safe Transport of Dangerous Goods by Air

INTERNATIONAL MARITIME ORGANIZATION

IMDG Code International Maritime Dangerous Goods Code

NATIONAL TRANSPORT COMMISSION, AUSTRALIA

ADG Code Australian Dangerous Goods Code

NEW ZEALAND BUILDING INDUSTRY AUTHORITY

NZBC New Zealand Building Code

RESPONSIBLE CARE NEW ZEALAND INC

HSNOCOP 2 Signage for Premises Storing Hazardous Substances

HSNOCOP 8 Preparation of Safety Data Sheets

HSNOCOP 16 Hazardous Substances Storage Code

HSNOCOP 36 Preparing for a Chemical Emergency

NEW ZEALAND ENVIRONMENTAL PROTECTION AUTHORITY (EPA)

Hazardous Substances and New Organisms (HSNO) Act 1996

UNITED NATIONS (UN)

Manual of Tests and Criteria

Recommendations on the Transport of Dangerous Goods—Model Regulations

B2 RELATED DOCUMENTS

Attention is drawn to the following documents:

AS

1678 Emergency procedure guide—Transport

1678.4.2.001 Part 4.2.001: Aluminium alkyls and aluminium alkyl halides

1678.4.3.002 Part 4.3.002: Magnesium phosphide

1678.4A1 Part 4A1: Group text EPG for Class 4.1 substances—Flammable solids; substances liable to spontaneous combustion; and substances that in contact with water emit flammable gases

HB 76 Dangerous goods—Initial emergency response guide

AS

1678 Emergency procedure guide—Transport

A/NZS

4745 Code of practice for handling combustible dusts

NEW ZEALAND DEPARTMENT OF LABOUR

Approved Code of Practice for the Prevention of Sulphur Fires and Explosions

NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

Priority Existing Chemicals Assessment Reports

PEC/5 Sodium Ethyl Xanthate

PEC/5s	Sodium Ethyl Xanthate Secondary Notification
NATIONAL FIRE PROTECTION ASSOCIATION (USA)	
NFPA 40	Standard for the Storage and Handling of Cellulose Nitrate Film
NFPA 484	Standard for Combustible Metals
NFPA 654	Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids
NFPA 655	Standard for Prevention of Sulfur Fires and Explosions

APPENDIX C
EMERGENCY PLANNING AND MANAGEMENT
(Informative)

C1 FACILITY EMERGENCY PLAN

The emergency plan for the facility should provide clear and robust guidance on how an emergency at the site is to be managed. At a minimum, it needs to meet regulatory requirements. It should be written in a clear format and include all relevant information such as the following:

- (a) Its aim and objectives.
- (b) Its scope, including clear identification of the site it applies to.
- (c) Other relevant parameters such as legal basis.
- (d) A description of the site it applies to, including people, locations, environment, boundaries, systems, plant and equipment.
- (e) The process by which it was developed.
- (f) The hazardous materials stored or handled at the site, and their means of containment.
NOTE: 'Hazardous material' includes dangerous goods, goods too dangerous to be transported; and combustible liquids
- (g) The potential hazardous materials emergencies (e.g. fire, explosion, spill, leak) and their potential impacts onsite and offsite.
- (h) A description of the emergency management system, including the following:
 - (i) The organizational structure in place to deal with a hazardous materials emergency, including the roles and responsibilities of persons holding positions mentioned in the structure.
 - (ii) The resources and equipment available to deal with a hazardous materials emergency.
 - (iii) The types and scales of emergency which may be handled safely and effectively by onsite resources and those for which the emergency services should be called upon.
 - (iv) The procedures that must be followed if a hazardous materials emergency happens, including:
 - (A) Alarm activation.
 - (B) Evacuation or shelter-in-place procedures, including activation of the warden system and, establishment of nominated assembly areas or shelter-in-place areas, away from the incident area and emergency services operations.
 - (C) Shutdown procedures.
 - (D) Establishment of emergency control centres.
 - (E) Fire fighting action.
 - (F) Activation of spill or firewater containment/pollution prevention systems.
 - (G) Mutual aid arrangements (e.g. cooperation with relevant authorities, use of equipment on neighbouring premises).
 - (H) Emergency termination.

- (i) The site plan as required for the manifest.
- (j) Other relevant drawings.
- (k) The telephone or other contact details of relevant personnel, emergency services and other agencies and facilities which may help in a hazardous materials emergency; also the criteria for contacting them and procedures to ensure that they are promptly alerted.
- (l) Arrangements for training of personnel in carrying out the plan and for exercising the plan (which may involve the local emergency services).
- (m) Arrangements for maintaining, reviewing and updating the plan (including documentation and its control, record keeping and exercises) and who is responsible for this.

NOTE: The information for Items (f), (i) and (k) is largely the same as that for the manifest.

C2 MANIFEST

C2.1 General

The minimum information to be contained in the manifest is specified in regulations. Additional information should be included where necessary to assist safe and effective conduct of response operations by the emergency services.

The manifest shall consist of three main components (see Clause 10.3):

- (a) Emergency contact information.
- (b) An inventory of hazardous materials at the premises.
- (c) A site plan.

A sample manifest is provided in Figure C1.

C2.2 Process for preparing the manifest

The following process can assist in preparing the inventory and site plan:

- (a) Identify each location (including 'in transit' storage locations) within the premises where dangerous goods/hazardous substances are—
 - (i) stored or handled in bulk, whether in tanks (excluding IBCs) or otherwise; or
 - (ii) stored or handled in packages or IBCs in quantities exceeding placarding quantities; or
 - (iii) manufactured.
- (b) Give each location a unique identification number or code.
- (c) For each location, determine for each type of dangerous goods/hazardous substance present in each of the following situations:
 - (i) For storage in tanks (excluding IBCs): the capacity of each tank.
 - (ii) For storage of solids in unconfined heaps or piles: the maximum likely quantity.
 - (iii) For storage in packages and IBCs: the maximum likely quantity in packages and IBCs;
 - (iv) Where dangerous goods/hazardous substances are manufactured: the maximum likely quantity in manufacture.
- (d) Prepare an inventory which provides in tabular form the following information against the identifying number or code for each location for each of the situations identified in Item (c):

- (i) for each type of hazardous material, the type and the maximum likely quantity,
 - (ii) additionally, for dangerous goods of Packing Group I or Division 2.3, the UN Number, Proper Shipping Name and Class/Division; and
 - (iii) for each tank, the UN Number, Proper Shipping Name and Class/Division of its contents, its capacity and other information specified in the regulation.
- (e) Prepare a scaled plan of the workplace (a site plan) that includes the following:
- (i) Shows the boundaries of the premises and names of adjoining streets.
 - (ii) The layout of structures and roadways within the premises.
 - (iii) Shows the position of each of the locations identified in sub-clause D2(a) above.
 - (iv) Includes the identification number or code and a description in words of each of those locations.
 - (v) Provides a legend for the identification numbers or codes.
 - (vi) Shows the location of:
 - (A) The main entrance and the other points of entry to the workplace.
 - (B) Site services, including fire services (such as alarm points, hydrants, boosters and other equipment) and isolation points for fuel, power and water.
 - (C) The manifest.
 - (D) The location of all drains on the site, including isolation valves.
 - (vii) Includes the direction of True North.
 - (viii) Indicates the nature of the occupancy of adjoining sites or premises (where practicable, include contact details).
 - (ix) Includes other information which may be necessary for the emergency services to conduct response operations safely and effectively.

The site plan should indicate the required information as clearly as practicable and be free of extraneous information. Paper size as appropriate (preferably A4 or A3) to provide the necessary information in a clear and legible format.

If all the required information cannot be shown clearly on one sheet of paper, consideration should be given to presenting it on several sheets. In this case, the individual sheets should be clearly and uniquely identified. A master sheet should be provided which clearly shows the spatial relationships of the other sheets.

When preparing a copy of the manifest for use by the fire authority in an emergency (e.g. to be stored in a hazmat box), consideration should be given to laminating the sheets for durability.

C2.3 Location of manifest

The manifest should be kept in a location specified by regulations or determined in consultation with the emergency services authority.

Usually, the manifest is housed in a red container ('hazmat box') located at one or more entrances.

Unless otherwise required by regulation or by the emergency services authority, the hazmat box should contain only the manifest. If other documents are to be located in the hazmat box, the emergency manifest shall be clearly identified and placed on top of the other documents and distinctly separated from them

Other information which may accompany the manifest includes the following:

- (a) The emergency plan.
- (b) The full hazardous materials inventory – a list of all hazardous materials on site with current quantities.
- (c) MSDSs for all dangerous goods specifically listed in the inventory (see Paragraph C2.2 (d)(ii).
- (d) Safety information for the emergency services which is not elsewhere provided, including location of clean-up materials.

NOTE: This information may be provided on a safety information board. A pictorial layout of the site or building may also be required.

- (e) Evacuation plan—details of the evacuation system at the site, including—
 - (i) the type of alarm and its means of actuations;
 - (ii) the locations of assembly areas; and
 - (iii) a means by which the emergency services can identify members of the warden structure for the premises.

C3 DOCUMENTS PROVIDING GUIDELINES ON THE PREPARATION OF EMERGENCY PLANS

- 1 PLANNING N.S.W. *Hazardous industry planning paper No.1: Industry emergency planning guidelines*. Sydney: Department of Urban Affairs and Planning, NSW, 1993.
- 2 PLANNING N.S.W. *Hazardous industry planning paper No.2: Fire safety guidelines*. Sydney: Department of Urban Affairs and Planning, NSW, 1993.
- 3 INDUSTRY AND ENVIRONMENTAL OFFICE—UNITED NATIONS ENVIRONMENTAL PROGRAMME. *Awareness and preparedness for emergencies at local level—A process for responding to technological accidents*. Paris: United Nations Publications, 1988.
- 4 INTERNATIONAL LABOUR OFFICE—GENEVA. R181, *Prevention of Major Industrial Accidents*. Geneva: International Labour Office, 1990.
- 5 RESPONSIBLE CARE NEW ZEALAND INC—HSNOCOP 36 *Preparing for a Chemical Emergency*.
- 6 PLASTICS AND CHEMICALS INDUSTRIES ASSOCIATION. *Emergency response and community awareness code of practice and implementation guide*. Melbourne: Plastics and Chemicals Industries Association, 1991.
- 7 QUEENSLAND DEPARTMENT OF EMERGENCY SERVICES (CHEMICAL HAZARDS AND EMERGENCY MANAGEMENT UNIT). *Emergency Planning: Guidelines for Hazardous Industry*. Brisbane: Department of Emergency Services, 1998.
- 8 QUEENSLAND DEPARTMENT OF EMERGENCY SERVICES (CHEMICAL HAZARDS AND EMERGENCY MANAGEMENT UNIT). *Emergency Plans: Guidelines for Major Hazard Facilities*. Brisbane: Department of Emergency Services, 1996.
- 9 DEPARTMENT OF CONSUMER AND EMPLOYMENT PROTECTION, W.A. *Dangerous Goods Sites—Emergency planning code*. Perth: Resources Safety, Department of Consumer and Employment Protection, Western Australia, 2008.

SAMPLE MANIFEST

DANGEROUS GOODS AND COMBUSTIBLE LIQUIDS MANIFEST

Occupier: Paramount Products Pty Ltd
 Address of premises: 24 Francis St Mainsville
 Date of preparation: 1 June 2010
 Site Plan Number: SP0610

Emergency contacts

NAME	POSITION	TELEPHONE	
		B/H	A/H
Sue Smith	General Manager	B/H 9876 5411	0412 345 678
Bert Jones	Operations Manager	B/H 9876 5415	0401 234 567
Tom Brown	Production Manager	B/H 9876 5419	0423 456 789

1 TANK STORAGE

Id No.	Dangerous goods					Tank	
	Name	UN No.	Class	Sub Risk/s	PG	Type	Capacity
DG T1	Petrol	1203	3	-	II	u/g	30000 L
DG T2	Petrol	1203	3	-	II	u/g	30000 L
DG T3	LP Gas	1075	2.1	-	n/a	a/g	3000 L
DG T4	Hydrogen Peroxide	2014	5.1	8	II	a/g	18000 L

u/g — underground

a/g — aboveground

2 PACKAGE STORAGE AREAS

2.1 Packaged dangerous goods of Packing Group I or Class 2.3

Storage area	Dangerous goods					Quantity	
	Name	UN No.	Class	Sub Risk	PG	Average	Maximum
PS1	Sodium Picramate	1349	4.1	-	I	20 kg	50 kg

2.2 Other packaged dangerous goods

Storage area	Class	Sub Risk(s)	Packing Group	Average Quantity	Maximum Quantity
PS2	6.1	-	III	10000 kg/L	15000 kg/L
PS3	3	-	II	15000 L	20000 L
	3	-	III	15000 L	25000 L
	3	8	III	600 L	1000 L
	C1	-	-	15000 L	20000 L
PS4	8	-	II	8000 kg/L	12000 kg/L

3 MANUFACTURING AREAS

Area	Class	Sub Risk(s)	Packing Group	Maximum Quantity
MA1	3	-	II	2000 L
	3	-	III	10050 L
MA2	5.1	8	II	1500 L
MA3	3	-	II	200 L
	3	-	III	25 L
	8	-	II	100 L
	8	-	III	2000 L

FIGURE C1 SAMPLE SITE PLAN OF A FACILITY

APPENDIX D
THRESHOLD TABLES FOR NEW ZEALAND
(Normative)

TABLE D1
QUANTITIES OF CLASS 4 SUBSTANCES THAT ACTIVATE
COMPLIANCE WITH THIS STANDARD AND ACTIVATE
THE REQUIREMENT TO OBTAIN A LOCATION TEST
CERTIFICATE FROM A TEST CERTIFIER

Hazard classification	Quantity for both open and closed containers
4.1.1A	1 kg
4.1.1B	100 kg
4.1.2A and B	1 kg
4.1.2C and D	25 kg
4.1.2 E, F and G	50 kg
4.1.3A, B and C	1 kg
4.2A	1 kg
4.2B and C	25 kg
4.3A	1 kg
4.3B	25 kg
4.3C	50 kg

NOTES:

- 1 If multiple Class 4 substances are stored, each with a different subclass, then refer to the Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001, Regulation 6 to determine if the threshold has been reached.
- 2 Refer to Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001, Schedule 3, Table 1 for a list of incompatible substances.

TABLE D2
MINIMUM CAPACITIES OF SECONDARY CONTAINMENT SYSTEMS FOR
SURFACE CONTAINERS

	Container capacity ≤60 litres	Container capacity > 60 litres ≤450 litres	Container capacity > 450 litres (including ISO containers and tanks)
Hazard Classification 4			
Pooling potential <5000 litres	At least 50% of the total pooling potential	At least 100% of the total pooling potential	110% of the capacity of the largest container
Pooling potential ≥5000 litres and <10000 litres	2500 litres	5000 litres	
Pooling potential ≥ 10000 litres	25% of the total pooling potential	50% of the total pooling potential	

NOTE: In circumstances whereby there are two or more containers of different capacities from this Table, the secondary containment system must have a capacity that meets the requirements for each container category.

TABLE D3
QUANTITIES OF CLASS 4 SUBSTANCES THAT ACTIVATE
THE APPROVED HANDLER TEST CERTIFICATE REQUIREMENT

Hazard classification	Quantity
4.1.1A	100 kg
4.1.2A and B	Any amount
4.1.2C and D	25 kg
4.1.2 E, F	50 kg
4.1.3A	Any amount
4.1.3B	100 kg
4.2A	Any amount
4.2B	100 kg
4.3A	Any amount
4.3B	100 kg

TABLE D4
QUANTITIES OF CLASS 4 SUBSTANCES REQUIRING FIRE EXTINGUISHERS

Hazard Classification	Description	Quantity	Number of extinguishers
4.1.1A	Solid	250 kg	2
4.1.1B	Solid	500 kg	2
4.1.2A, 4.1.2B, 4.1.2C, 4.1.2D, 4.1.2E, 4.1.2F, 4.1.2G	liquid	50L	1
		200L	2
	Solid	50 kg	1
		200 kg	2
4.1.3A, 4.1.3B, 4.1.3C	Liquid	50 L	1
		200 L	2
	Solid	50 kg	1
		200 kg	2
4.2A	Liquid	50 L	1
		200 L	2
	Solid	50 kg	1
		200 kg	2
4.2B	Solid	250kg	2
4.2C	Solid	500kg	2
4.3A	Liquid	50L	1
		200L	2
	Solid	50 kg	1
		200 kg	2
4.3B	Liquid	250 kg	2
	Solid	250 L	2
4.3C	Liquid	500 kg	2
	Solid	500 L	2

NOTE: The fire extinguishers indicated above are for fires involving the Class 4 dangerous goods. Additional extinguishers may be required for other surrounding materials.

NOTES

NOTES

Standards Australia

Standards Australia is an independent company, limited by guarantee, which prepares and publishes most of the voluntary technical and commercial standards used in Australia. These standards are developed through an open process of consultation and consensus, in which all interested parties are invited to participate. Through a Memorandum of Understanding with the Commonwealth government, Standards Australia is recognized as Australia's peak national standards body.

Standards New Zealand

The first national Standards organization was created in New Zealand in 1932. The Standards Council of New Zealand is the national authority responsible for the production of Standards. Standards New Zealand is the trading arm of the Standards Council established under the Standards Act 1988.

Australian/New Zealand Standards

Under a Memorandum of Understanding between Standards Australia and Standards New Zealand, Australian/New Zealand Standards are prepared by committees of experts from industry, governments, consumers and other sectors. The requirements or recommendations contained in published Standards are a consensus of the views of representative interests and also take account of comments received from other sources. They reflect the latest scientific and industry experience. Australian/New Zealand Standards are kept under continuous review after publication and are updated regularly to take account of changing technology.

International Involvement

Standards Australia and Standards New Zealand are responsible for ensuring that the Australian and New Zealand viewpoints are considered in the formulation of international Standards and that the latest international experience is incorporated in national and Joint Standards. This role is vital in assisting local industry to compete in international markets. Both organizations are the national members of ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission).

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